THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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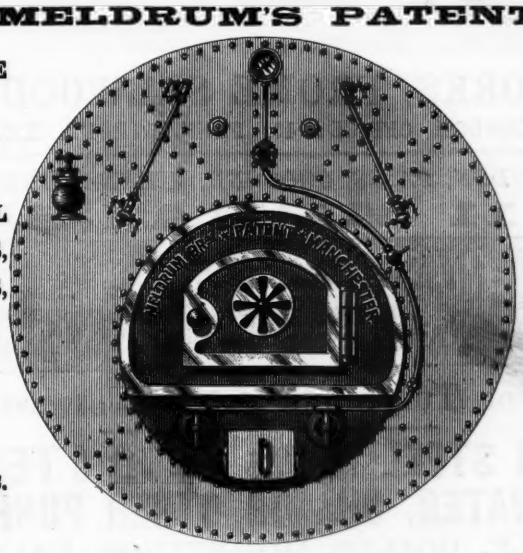

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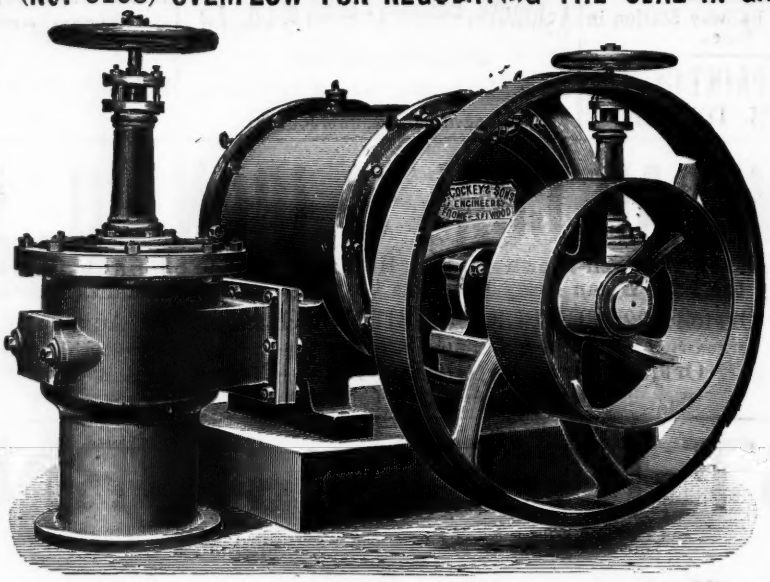

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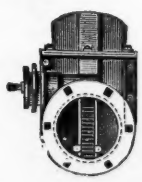

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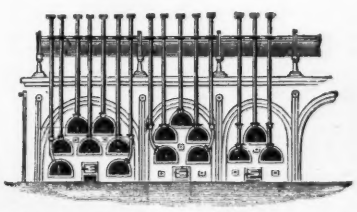

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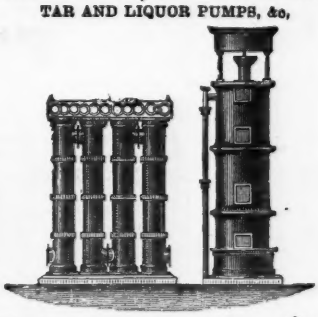

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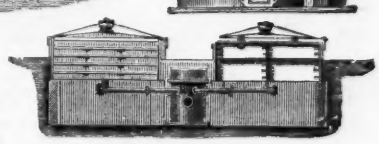

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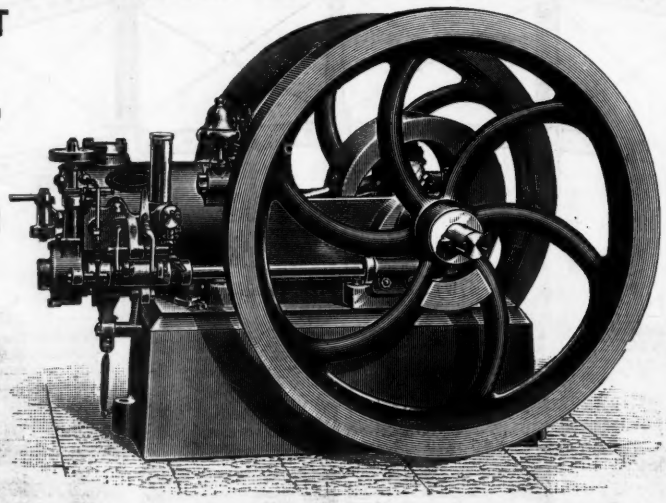

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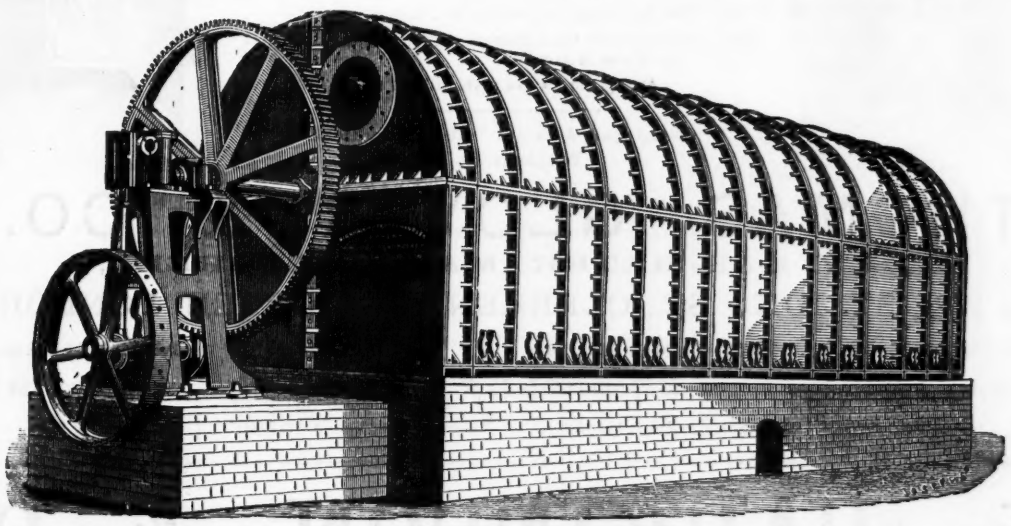

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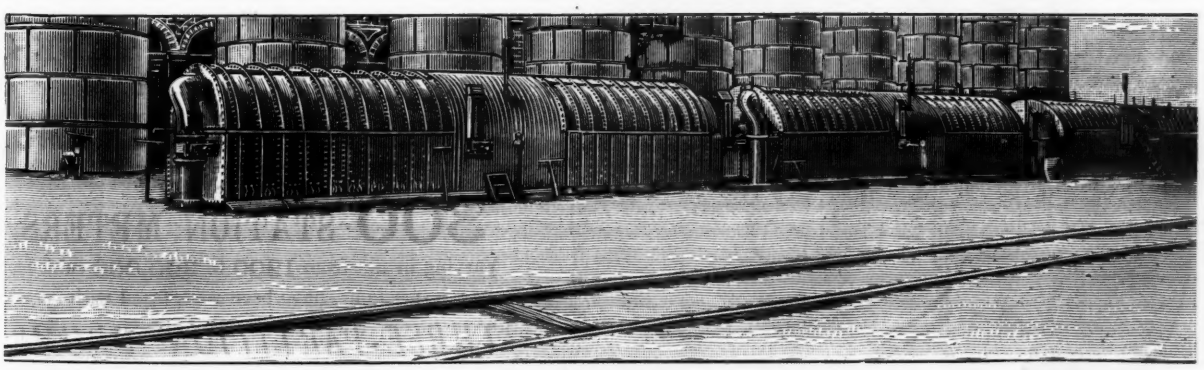

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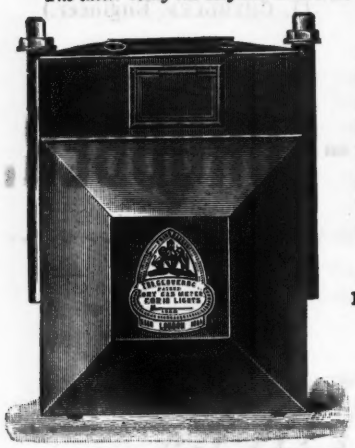

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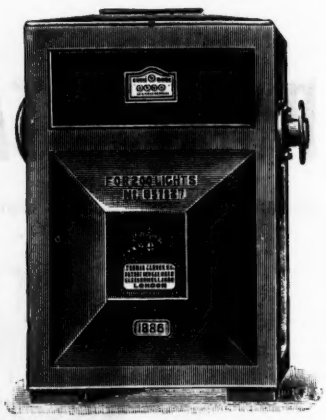

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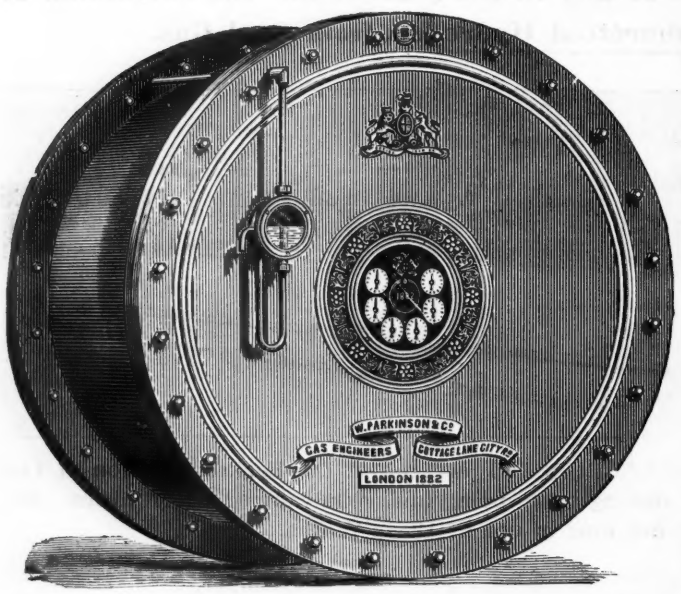

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JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 20, 1893.

The Belfast Meeting of The Gas Institute.

THE meeting of the Incorporated Gas Institute at Belfast in the past week was, after all that has been said about the prospects of the gathering, far more successful than was expected even by the most sanguine friends of the Institute. This result was due to the operation of a number of causes which can be easily enumerated after the event, but which might just as likely have failed to make themselves felt in this way. In the first place, the very dread lest the meeting might not be well attended, to which we gave expression in our issue for the 30th ult., undoubtedly acted as a spur to those who might have felt more than half inclined to stay away. It was in order that this might be so that we raised the alarm betimes, and warned all and sundry that it was most desirable that whoever took "a sincere interest in the Institute should make a "determined effort to attend the meeting." Oddly enough, this warning was looked upon in some quarters as a sort of attack upon the Institute; but the result has amply justified the line we took in commenting upon the prospects of the meeting. As it turned out, the muster on the first day, to hear the Presidential Address, was almost as large as could have been anticipated in the palmiest days of the Institute in the same circumstances. And throughout the three days of the meeting the attendance for the hearing and discussion of papers was very creditable, notwithstanding the fact that the weather outside was a constant temptation to truancy, and the hall was almost unbearably hot and stuffy.

Such as it was, the attendance was chiefly drawn from the North of England and Manchester districts, with a strong contingent of the local element from the North of Ireland Association. The men upon whom the burden of keeping the Institute going for the last two or three years has mainly fallen were, of course, well to the fore; but many others whose names have been closely associated with the organization down to the present time were absent. But, on the other hand, several new names will appear in the reported discussions, which is, so far as it goes, a sign that the general body of members are taking an interest in the proceedings. This movement must be strengthened if the Institute is to do any good in the future, when the hands that have fostered it of late years leave it more to itself. It is, as we have always argued, the idlest of complaints against an organization of this kind to charge the administration with being a "clique." Of course it is, and was, and will be to the end of the chapter. The Institute is managed by a "clique," like the Institution of Gas Engineers, the Society of Engineers, the Institution of Mechanical Engineers, and the Institution of Civil Engineers—indeed, all scientific and technical bodies up to the Royal Society itself. The managing "clique" simply means the mere handful of members who really take a lively interest in the prosperity of the organization. There must be such men, or no mutual association could endure beyond its first or second year of life. The great bulk of members are content to have their corporate affairs managed for them by those energetic spirits who will take the trouble to do it; and it is silly to cavil, as a discontented minority will always be found to do, against the notoriety or the eminence—whichever it may be called—that is earned by the managing "clique." When the members of a "clique" of this kind are wise, however, they will be the reverse of exclusive. The work of the organization must be seen to by somebody; but there is no reason why it should always be by the same individuals. We do not believe the moving spirits of The Gas Institute, as at present constituted, are in the slightest degree disposed to be exclusive, albeit they are obliged to assert themselves occasionally against those who make it their ruling principle to be "against "the Government." We go further, and declare that the management of the Institute never was intentionally exclusive, although the old constitution powerfully fostered this failing by the number of permanent officers which it imposed upon the organization. It is time, however, that the general body of members of the Institute realized the fact that the powers of an administration are limited—more for good, perhaps, than for evil. Bad management may quickly wreck a mutual association; but the best administrative ability at head-quarters will not keep a society alive without the co-operation of the members generally.

It cannot be said that the members of the Institute, as a whole, support their Council in the way this body would like to be supported. True it is that there was a fair assembly last week in Belfast, in point of numbers. But they were not all gas managers, by any means; and, of the others, very few were capable of contributing a

paper or of discussing it. Then as to the work of the members themselves, it cannot be pretended that the three papers read at the last meeting, however good they may be, adequately represent the intellectual force of the Institute. One hears it asserted from time to time that there is plenty of reserve strength in the Institute; but it would be more satisfactory if it were not quite so reserved. It is nonsensical for any member to grumble at the Council for going outside the Institute for the principal source of attraction to the meetings. What would the Belfast programme have been like without Professor Lewes and Messrs. Donkin and Dowson? We understand that at one time the Council had promises of several papers, and that the engagements were broken at the last moment; thus leaving them "in the lurch" in a matter of capital importance. If this was really the case, uncommonly good excuses will be required to exonerate the offenders from severe condemnation. The members who attended the Belfast meeting had no difficulty in talking at large about the subjects presented to them; but conversation upon technical subjects, although taken down by a shorthand writer, is not always discussion.

The success of the Belfast meeting, in the technical and social sense, was largely due to the President—Mr. Denny Lane—who must be almost tired of being assured on all hands how general and great a favourite he is with all sorts and conditions of men, and especially with the followers of the gas industry. It does not matter what the society is called over which Mr. Denny Lane happens for the time being to preside; he is competent to elevate its proceedings and dignify its character. It is much to be regretted that the President had so little opportunity last week of exhibiting amid fitting surroundings the courtliness that so markedly distinguishes this fine old "Republican of '49." The so-called official reception of the Institute by the Lord Mayor and Corporation of Belfast was but a mere incident of an incident, utterly undeserving of the name of a municipal function; and it is a great pity that there was no worthier opportunity provided for the display of the President's social gifts, and the exercise of his ever-ready wit, than was afforded by a hastily got-up smoking concert. Through this shortcoming, half the President's value was wasted.

To say that Professor Lewes ably discharged the task of lifting the technical transactions of the Belfast meeting from the commonplace, is only to state that this brilliant lecturer and debater was in capital form, and gave the Institute of his best; and it is unnecessary to show how good this is. We doubted, and still doubt, whether the Council were quite wise in "playing" Professor Lewes again this year; but as they decided on doing so, it is only fair to put it upon record that the result was unquestionably a triumph for him. Professor Lewes went to Belfast one night, on the following morning delivered his lecture—which, by the way, takes altogether a novel view of the subject expressed in the title—read a paper, and replied to the discussion upon it in a speech almost as long, and quite as interesting, as the original composition to which it related, and returned to London the same afternoon; having, in the short time of his stay, established an Irish reputation comparable only to his English renown. In the slang of the day, his was a "record" performance.

Lastly, we desire to recognize the admirable manner in which the young Secretary of the Institute, Mr. F. G. Burfield, acquitted himself of the duties appertaining to his office. Alert, attentive, and unobtrusive, he won golden opinions during the meeting, and did everything as smoothly as though such work came by nature. A good deal of responsibility, and of consequent anxiety, also fell upon Mr. Hepworth. This meeting has given him much trouble, first and last; but he has now the satisfaction of knowing that his devotion to the Institute has been rewarded. To Mr. Stelfox, also, belongs great credit, for the hearty way in which he worked in order to ensure that the visitors to Belfast should have a pleasant and an instructive sojourn.

The French Gas Managers' Society.

THE Annual Congress of the Société Technique de l'Industrie du Gaz en France was held in Paris last week; thus clashing with The Gas Institute meeting, as too often happens with these two national associations of gas engineers. If neither society had anything to do with the other, this synchronizing of the dates of the meetings would not matter; but seeing that for years each society has passed the compliment to the other of electing its President an honorary member, it is a touch of absurdity to so arrange the two annual assemblies as to render it impossible for these honorary members to put in an appearance as a recognition of the international courtesy. This point was mentioned by Mr. Denny Lane on Thursday last; and it is a question of administration that may well receive further attention. The French gas engineers assembled on Tuesday morning under the presidency of M. Mallet, for the transaction of the formal business of their Society. The congress was opened in the afternoon, when the Presidential Address was delivered; and prizes were awarded—first, for the best papers communicated to the congress of last year; secondly, to those persons who have brought out the best new gas apparatus and appliances; thirdly, to deserving workmen. The reading of papers was an order of the day; and on Wednesday morning a report was received from a Committee consisting of the three last Past-Presidents (MM. Cornuault, Salanson, and Melon) upon the most conspicuous improvements in the way of apparatus for the utilization of gas that have been brought out since 1889. The afternoon was devoted to inspections of works; and a subscription banquet was held in the evening. Thursday was similarly occupied in the reading of papers and outdoor inspections; and the customary excursion was omitted—the attractions of Paris being probably considered sufficient to amuse the provincial attendants at the congress. Three memoirs were presented in competition for a prize; their subjects being respectively "The Extraction of Cyanogen from Gas Liquor," "The Gas Industry in 1893 in Competition with Electricity and Petroleum," and "How to Construct a Gas-Works." This device might very well be considered by The Gas Institute. In all, twenty-three signed technical communications, of one sort and another, including "Notes" on minor points of technics, were comprised in the programme of the congress, several of which promised, by their titles, to be important compositions. No report of the congress has yet reached us; but there is every reason to suppose that the gathering of the gas engineers of France in the capital was as large, representative, and successful as usual. It will be interesting to see, when M. Mallet's address comes to hand, whether he has anything to say concerning the critical condition of the relations between the Paris Gas Company and the Municipality.

Gas Prices and Profits at Coventry.

THERE has been a discussion in the Coventry Town Council on a resolution proposed by the Chairman of the Finance Committee, which contemplated fixing the price of gas at such a figure that an amount of profit equal to the product of a district rate of at least 2d. in the pound should be made every year, to be applied in relief of the general district rate. This suggestion fairly brought up the important question of how the interest of ratepayers is to be balanced against that of gas consumers; and it is satisfactory to learn that eventually the resolution was rejected by a large majority. As a matter of fact, the Coventry Gas-Works at present return a profit which has varied during the last three years from £309 to £2000, and stood last year at £1103, which amount has gone in relief of the rates. These fluctuations were, of course, due to the same causes that have operated elsewhere; but it is perfectly easy to understand how they must have vexed the soul and upset the accounts of the worthy gentleman who, in a reformed municipal corporation, is charged with the onerous duty of making both ends meet. What is the use to such a man of a source of revenue that may amount to £2000 one year and shrink to a sixth of this sum during the next? If anything is to be paid by way of subsidy, he naturally wishes to know how much he has to depend upon in this way, in order that the balance to be raised by direct rating may be ascertained. It is hard enough for a municipal financier to keep to his estimates with only one side of the account—the expenditure—liable to unforeseen and unavoidable disturbances. If the income is also to be uncertain, the consequences must be simply deplorable. In the circumstances, therefore, Mr. Alderman Tomson, of Coventry, is only speaking words of truth and soberness when he asks the Corporation to order the Gas Committee to make a yearly profit equal in amount to a twopenny rate. If the Gas Com-

mittee would only do this, the Finance Committee would know where they stand. There is no particular reason why the Coventry subsidy should be put at the exact figure given, except that this amount has been paid before, and the Finance Committee would like to have it again. Unfortunately for his case, the Chairman of the Finance Committee, in his speech to the Council, went far beyond and behind this convenient twopence. If he had merely said: "This is a handy sum; we have had it before, and "should like it for a permanency," it is possible that he might have done better. As it was, he went on to talk about the credit of the ratepayers having been pledged to buy the gas-works, and their right to some return, and so on—all which brought up the Chairman of the Gas Committee to say that, while this Committee were neutral in the matter, it was wrong to allege that any loss upon gas making would fall upon the general body of ratepayers, since it would be met by increasing the price of gas. "Tell us what you want us to do," said this diplomatic gentleman, "and we will try our best to carry "out your wishes. Only please understand that the order "to make the price of gas so as to ensure a profit equiva- "lent to a twopenny rate is yours, not ours." This hint of the natural connection between gas profits and prices appears to have had a wonderfully sobering effect upon the Coventry town councillors, most of whom may be supposed to be gas consumers. And when somebody showed that the class which would derive most benefit from this kind of indirect rating is that of owners of tenement property, who do not burn gas but stand to pay rates, and give a deal of trouble to the Corporation in many ways, the evil and injustice of making the gas consumer pay rates for non-consumers became undeniable; and the Chairman of the Finance Committee was fain to confess his defeat. The majority thought they were very well pleased with the results of the working of the gas undertaking, as they have turned out for these eight years past. The price of gas has been reduced, and still the Gas Committee make a nice little profit, averaging about £1000 a year, which goes in relief of the rates. With this, it is evidently thought, the Finance Committee should rest content, and not drive the gas consumers into a position of opposition to non-consuming ratepayers, as would certainly be the result of any further accentuation of the difference between the contributions of the two classes of inhabitants to the expenses of the town. It would be too much to expect the Coventry Town Council to be logical, and say that ratepayers who do not burnt gas shall not benefit at the expense of those who do. It is a good deal that the Council see the injustice of the practice, and decline to follow it beyond a certain comparatively harmless limit.

Field's "Analysis"—A New Table.

THE latest issue of Field's "Analysis"—that for the year 1892—has just appeared; and we desire to recognize the solicitude of the compiler of this indispensable book of reference to keep abreast of the age, and to extend the scope of his analytical labours. It is a sign of the times that, in dealing with the accounts of those undertakings in which enriching material other than cannel is used, the compiler "has again adopted generally the figures of 75 "gallons of petroleum oil and 50 gallons of petroleum "spirit as equivalents of one ton of Lesmahagow." The exceptions to this general rule are the "few cases in which "other equivalents have been specially furnished," and for which the compiler has therefore no responsibility. Besides the information contained in the tables, the notes to many of the entries constitute a valuable exposition of peculiarities in current gas-making practice. The present issue contains an additional table, given as an appendix, stating the amount of capital employed per 1000 cubic feet of gas supplied on the days of maximum delivery occurring in the "account year," and also "on record." The table likewise contains a column giving the proportion of maximum daily delivery to annual make. Some of the figures, the like of which have never been put together before, compare very strangely among themselves. It is the habit of gas engineers to reckon roughly a year's output as 200 times the maximum daily production. This ratio is exactly realized by only one town in the list—Plymouth—although Lea Bridge, Newcastle-on-Tyne, the South Metropolitan Gas Company, Bristol, and Leicester closely approximate to it. For the three Metropolitan Companies, the maximum daily delivery stands to the annual make as 1 : 181. The West Kent Gas Company (supplying a purely residential and suburban district) have the lowest fraction, of 1 : 213; although the Portsea Island Company are very near them with a ratio of 1 : 212. The highest fraction is owned by Oldham, with a ratio of 1 : 134; but all the factory towns are the same way—that is to say, they have a comparatively high daily maximum in comparison with their yearly output. In the matter of capital employed per 1000 cubic feet of the daily maximum on record, which it is the principal object of the table to set forth, there appear some astounding differences, difficult to the verge of impossibility to reconcile by any tangible principle. The average of the London Companies under this head is £91·6—the highest being The Gaslight and Coke Company, with £94·1; and the lowest being the Commercial, with £71·6. In the case of the Lea Bridge Company, however, the figure mounts up to £200·6; while another Suburban Company—the Wandsworth and Putney—does it for £57·4. The minimum is touched by the Plymouth Company, with £32·9; and Glasgow has only £47·3 against it. The whole thing is a puzzling development of gas-supply statistics.

WATER AND SANITARY AFFAIRS.

A NOTABLE event of the past week consists in the action of the House of Lords Committee on the General Powers Bill of the London County Council. The House of Commons had agreed that the Council should have four representatives on the Thames Conservancy Board, and three upon the Conservancy Board of the River Lea. Hitherto the Council have been unrepresented at the former Board, and have sent only one member to the Lea Conservancy. The Lords' Committee have declared that the preamble of the Bill is not proved in either case; and thereby the Council are left where they were before, with simply one representative on the Lea Conservancy and none on the Thames. The decision of the House of Commons is also reversed in another particular; the Committee of the Lords refusing to authorize the expenditure by the Council of a sum not exceeding £10,000 per annum for conducting inquiries and negotiations. "Much indignation" is expressed in certain quarters at these decisions of the Duke of Richmond's Committee; and if we are to believe what some parties declare, the consequences will be serious for the Upper House. At all events, there is to be a fight on the subject in the House of Commons; and an expectation is expressed by the malcontents that the Government will support them on a motion to disagree with the Lords' amendments. But the evidence given in support of the claims put forth by the County Council was quite sufficient to justify the action of the Committee. Mr. Binnie, the Chief Engineer to the Council, was candid enough to admit that, if the Council were to send representatives to the Thames Conservancy, they would "use all their influence" to get rid of the agreements by which the Companies were enabled to obtain an enlarged supply of water. There was the further confession that "there must be antagonism of interest "where a possible future purchaser and seller were con- "cerned." Representation on the Board of the Thames Conservancy was, therefore, to be used as a means of embarrassing the Water Companies, and restricting the supply of water to the Metropolis. The future transfer of the property was to be kept in view; and every effort was to be used to reduce the efficiency and value of the undertaking which was to be acquired. Whether or not London wanted the water did not signify, except that a failure in the supply might bring the Companies into ill-repute, and so prepare the way for the Council. Mr. Dickinson, their Deputy-Chairman, took up a position similar to that maintained by Mr. Binnie, and stated that, if the Council had been represented at the time, he did not think the agreements to allow the Companies to draw so much water from the river "would "have been permitted"—that is to say, the supply would have been cut short, and a crisis would have been precipitated. There is a delicate little hint in Mr. Dickinson's evidence that, if the County Council sent four representatives to the Thames Conservancy Board, the staff of the Council would "assist" the Conservators, and possibly "a special rate" would be levied over the whole of the Metropolis to further the designs of the Council. Of

course, the intention would be to oust the Water Companies altogether with regard to the Lea as well as the Thames. The *Daily Chronicle* is irate at the present failure of these designs, and predicts "an overwhelming demand" for such legislative action as shall give "the people of "London not merely partial, but absolute control, through "properly appointed representatives, of the waters of the "Thames and the Lea," that is to say—no more Conservancy Boards, but the London County Council everywhere. The parliamentary machine is also to be reconstructed, the "Hereditary Chamber" is to be set to rights, and the two "moribund" Conservancy Boards are to be swept away.

Two of the London Water Companies held their half-yearly meeting last week. The speeches from the chair showed there had been trouble with the frost during its prevalence in the winter; but the present drought caused no anxiety. There was water enough and to spare. The Southwark and Vauxhall shareholders suffered "a little "pinch" in respect to their dividend—dropping from 6½ to 6 per cent.; whereas the Grand Junction were more fortunate, as they were able to divide 8½ per cent. Mr. F. Tagart, in presiding at the meeting of the latter Company, gave it as his idea that, "among the more eminent members" of the County Council, there were indications of a better feeling towards the Companies. To some extent this view may be correct, as in the case of Sir Thomas Farrer; but the leaven of good sense and right feeling is very small at present compared with the mass. It is perfectly true, as Mr. Tagart expresses it, that the interests of the Companies are identical with those of the ratepayers; but it happens that the County Council have other interests than those of the ratepayers at heart, and here the antagonism exhibits itself.

At each of the two meetings held last week, the Chairman of the Company made reference at some length to the subject of filtration. The Southwark and Vauxhall Company are described by Alderman Sir H. E. Knight as making rapid progress with their new filter-beds; and Mr. Tagart speaks of the Grand Junction Company as developing their system of double filtration, to which Dr. Frankland attributes very considerable importance. But in all cases, the filtration practised by the London Water Companies yields excellent results, though an ingenious American, Mr. E. H. Riddell, thinks to make matters better still, for which purpose he proposes a new method of cleansing the sand which forms the upper part of the London filter-beds. Mr. Riddell's representative acknowledges that the London water, "although hard, is very good." But he thinks "a more "certain and uniform degree of excellence" may be obtained by the use of Mr. Riddell's apparatus. It is stated that at present "the authorities have no certain means of ascer-"taining when it is necessary to clean the beds." This is not altogether correct, seeing that Dr. Frankland, among other tests affecting the supply, ascertains the bacteriological state of the water as it issues from the beds, and before it is pumped into the distributing-mains. Any failure in the action of the filters is thus detected by a process which deals directly with the question of the microbes. "The principal advantage" claimed for Mr. Riddell's method is that of its economy. We certainly cannot expect better results than those which are now obtained, seeing that, as a general rule, 98 or 99 per cent.—sometimes even more—of the microbes are arrested. But if Mr. Riddell's system is cheaper than, while equally efficient with the present plan, there is good reason why the London Water Companies should consider its merits. At the same time, it is a singular feature in the filtration of water through sand, that sand freshly washed does not answer so well as that which has been in action for some little time.

The Management of the Annan Gas-Works.—Mr. J. Smith, a local plumber, has been appointed Manager of the Annan Gas Company's works, in place of Mr. W. Ewart, resigned.

Death of Mr. H. Gill, of Berlin.—We regret to record the death, on Saturday last, in Berlin, of Mr. Henry Gill, M.Inst.C.E., Engineer and Manager of the Berlin Water-Works. The deceased was in his 69th year.

The Proposed Transfer of the North Berwick Gas-Works to the Town Council.—On account of the illness of Mr. R. T. C. Linton, of Leith (who, we are pleased to learn, continues to improve in health), Mr. J. M'Gilchrist, of Dumbarton, has been appointed Arbiter in the proposed transfer of the undertaking of the North Berwick Gas Company to the Town Council.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTIETH ANNUAL GENERAL MEETING,

HELD AT

THE CITY HALL, BELFAST, JUNE 13TH, 14TH, & 15TH, 1893.

DENNY LANE, ESQ., M.A., President.

REVIEW OF PROCEEDINGS.

IT is almost superfluous to remark that truly magnificent weather favoured the Incorporated Gas Institute when the prospects of the Belfast meeting were put to the test of the actual assembly of the members in the commercial capital of Ireland. A doubtful point in regard to the sufficiency of hotel accommodation was happily resolved at the outset by the discovery that the new Grand Central Hotel, with its 250 rooms, had been opened a week before the date of the meeting; and this really palatial establishment was the head-quarters of the President and Council, and of the great body of members, during the week. Many members from England started early, so as to have a few days upon the picturesque Antrim coast before repairing to the rendezvous in Belfast; and in the course of Monday and Monday night the stream of arrivals was continuous, auguring well for the attendance at the City Hall on the following morning—an augury which was satisfactorily fulfilled in due course, for the meeting which greeted the Lord Mayor and the President when these dignitaries entered the Council Chamber on Tuesday to formally open the session was as large as the best friends of the Institute could have desired, and larger than was generally expected. Members and visitors, there were about 220 present.

The proceedings of Tuesday began with the official reception of the Institute by the Lord Mayor and Corporation of Belfast, which was a much briefer function than such ceremonies commonly are, so that there was no delay in attacking the programme; and the first important piece of business—the adoption of the report of the Council and the statement of accounts for the year—was soon reached. Upon this it is desirable to offer a little comment, since for a statement of so great magnitude it cannot be said to have been adequately discussed by the meeting.

The report is not a very pleasant-reading document for anyone who has the interest of the Institute at heart; and the opening sentence, in which the Council declare their "pleasure" in having to present such a statement, must be taken as a more than ordinarily conventional form of expression. The second paragraph, referring to the engagement of the Council and President to co-operate with the London Chamber of Commerce in the matter of the Chamber of Arbitration established by the latter body, is one of the most satisfactory in the whole report. In offering to undertake the duties of arbitrator in gas disputes, or to appoint a substitute, the President of The Gas Institute for the time being will be doing all that can be expected or desired of anyone in his position to help in reducing the exorbitant cost of commercial litigation, which now so frequently amounts to denial of justice.

The recruits to the ranks of the Institute barely repair the waste due to death and defections. The roll of membership including all classes now shows a total of 569; and this probably represents the full strength upon which the Institute can reckon for the immediate future, for the effect of the great disruption has probably been spent by this time. This consideration leads on directly to the accounts of the position and year's working of the Institute, by which the phraseology of the report is illustrated and supported. The revenue account shows that a sharp turn must be made by the administration in the direction of economy, if the Institute is to pay its way with the reduced membership. It appears that, ever since the "split," the Council of the Institute have been carrying on the concern as though they had more rather than less income than before to depend upon; and the result has been a serious weakening of the financial position. There is a loss for the year of £104; and the problem before the Council is that of reducing their gross annual expenditure

of £823 by at least £150. It would appear that £650 per annum is as much by way of income as the Institute can safely reckon upon in cash; and, in order to make this sufficient for the current needs of the organization, the pruning-knife must be used ruthlessly on the debit side. In the present accounts, for example, the expense of offices stands for nearly £110; the Secretary costs £200; and the printing and binding of the Transactions amount to £234. All these charges are excessive, and cannot be justified by any admissible reference to the needs of the Institute. The three items make together nearly £550 per annum; and they afford ample scope for the economy that is already indicated as imperatively necessary. In the first place, the resignation of Mr. W. H. Harvey has opportunely put the Council in possession of the power, which they have already utilized, of appointing a less expensive, and in all probability equally serviceable, officer in the person of Mr. F. G. Burfield, whose qualifications for the post are, we understand, unexceptionable. Secondly, the expensive and little-used offices in Victoria Street may well be given up entirely, and a cheaper, but equally respectable, domicile acquired for the Institute in another part of London. Lastly, in the matter of the printing and binding of the volumes of Transactions for the past two years, it is clear that, by some more business-like arrangement in this regard, much money might be saved. We have often commented upon the absurdity of wasting money upon the so-called independent reports of the proceedings of these technical society meetings, seeing that in all such cases the technical press reports papers and speeches promptly, and with ample fulness. This observation does not apply to The Gas Institute any more pointedly than it does to any other similar body, only in this instance the society cannot afford to squander its means. Such is the force of custom, however, that every technical society, however struggling its position may be, thinks it necessary to pay for reporting and setting up its proceedings, as though no other means of publication existed; and what happens? It is true that a technical journal can rarely afford the space for, and the cost of reproducing elaborate diagrams or plans, such as accompany some papers read before public meetings; but, with this exception, it is undeniable that ninety-nine men out of a hundred who are interested in the transactions of such meetings, and who are prevented from attending them in person, obtain their knowledge of what has been said and done from the journals of the day. And, as a rule, the belated official reports are worked up from, if not wholly based upon, those which the journals give. We would ask any *habitué* of technical society meetings: Who works hardest at the reporters' table—the official reporter or the journalistic reporters? The conclusion is obvious. The best and most economical way of getting out a volume of Transactions is by co-operating with the publishers of the best journalistic report, and then making the volume worth buying by those who read the journals, by putting into it plenty of plates and other valuable matter of lasting value which the scheme of technical journalism does not touch.

Mention is made, in the report, of the intended issue of a General Index to the papers and proceedings of the Institute from the commencement. We wish this movement could be extended, and made to form part of a system of scientific and technical indexing. The next subject dealt with is something which must certainly be deplored. It is a statement to the effect that the Council "have given consideration to the desirability of providing members with certificates recording their connection with the Institute, and have decided to issue the same." This suggestion for issuing membership certificates has always been hovering over the Council from the earliest days of the old British Association of Gas Managers; and the collective wisdom of the "hard-headed" ones (to use a recent expression of Mr. Newbigging) was always against anything of the kind. If it were any sort of distinction to belong to the Institute, a certificate to this effect might be worth having, and framing and displaying in a member's office. It is with no desire to apply the observation in an invidious sense that we point out that this quality of distinction cannot belong to a purely mutual society, like The Gas Institute, admission to which does not at all depend upon merit, but purely and solely upon status or office. Any gas manager—any sort of gas manager—can belong to the Institute; and why the fact of so being should be recorded on a certificate needs to be explained. If there is such an organization as a Society of Parish Clerks, is the fact of being a parish clerk, and therefore eligible for membership of the Society on condition of paying a subscription, worthy of being chronicled in a framed and glazed form? Is it in contemplation to formally sanction the use of the initials "M.I.G.I." after the name of a possessor of these Gas Institute certificates? If not, why not? The whole thing wilts under critical examination; being part and parcel of that craze for the use of meaningless tails of initial letters after the surname which certain professional men have recently denounced.

In awarding the President's medal for last year's papers and the first premium to Mr. A. T. Walmisley, the Council showed their appreciation of his really good work. In acknowledging the distinction, Mr. Walmisley made some sensible remarks upon the value of writing papers as a means of technical education. The second and third premiums went to Mr. W. R. Chester and Mr. T. Newbigging respectively.

It was half-past eleven when the President rose, amid a hearty round of applause, to pronounce the address which we gave in last week's JOURNAL; and it occupied one hour and twenty minutes in the delivery. The President is always interesting; and his Belfast address is, as a whole, one more evidence of his possession of a mind so large and so richly cultured that of him may truly be said, in a phrase unhappily hackneyed, that "he touches nothing that he does not adorn." The sincerity of our meaning must be our excuse for the employment of this too-familiar form of acknowledgment of a personal quality that cannot so well be described in fresher language. The address began with a very natural reference to the circumstances attending the orator's second tenure of the position of chief officer of the Institute; and it went on to comment lightly, and in perfectly good taste, upon the national peculiarities of the occasion. Mr. Denny Lane admitted the arduousness of the position of a president of a society of gas managers in these days, when the demand for something new in an Inaugural Address is rendered more and more difficult of fulfilment by the frequency of such efforts; and he offered a small apology for striking out a line of his own, and entering upon an incursion into the country with which he is so familiar, and in which he is so interested—the region where the speculative electrician disports himself. The first thing the President did was to fall foul, as we have often done before him, of Mr. W. H. Preece, whose habit of "reckless assertion" he exposed with relentless logic, and whose "dignified style" he ridiculed with a wealth of apt and scholarly sarcasm. Other electricians and electric lighting companies were next passed in remorseless review, which led up to the triumphant conclusion that "the increase of gas consumption in London alone in one year would give once-and-a-half as much light as the whole electric lamps of Great Britain." This is a pretty lively relic of what some present-day electricians are fond of pretending to regard as a past "gas age."

The President discussed the oft-debated subject of the "load factor" in central station lighting, with his habitual skill and play of fancy. All this is highly instructive and very entertaining; but it certainly runs into a good deal of printed space. The gift of condensation in speech is, however, hardly to be expected of an Irishman; and the highest compliment one can pay to Mr. Denny Lane is the admission that he is one of those who do not cause us to regret its absence. He next dealt luminously with the so-called storeage of electricity, and with the proposed substitutes suggested by Professor Forbes and Mr. Halpin. In connection with the former, which is based upon the potentiality of energy in water stored at an elevation, he gave his own mnemonic rule, which helps us to remember easily that "one acre of water, one foot deep, gives one horse power for one hour for (each) one foot of fall." This formula shows in an instant how large an impounding area is needed, or how great an elevation, in order that stored water may afford any useful amount of power. We are reminded here of the strange mistakes that have been made with regard to the power of falling, or flowing, water, which once led to the demonstration that all the apparently resistless force of the tides at London Bridge which could conceivably be utilized, at enormous structural expense, would hardly suffice to feed arc lamps enough to light the bridges.

After this severe handling of Professor Forbes, Mr. Druitt Halpin fell an easy victim to the President's destructive criticism; and the address, which, while dealing with electric lighting problems, had never left gas supply far out of sight, turned back to a "home" subject, and asserted the advantage of employing gas-engines for generating electricity. The President acknowledged the gratifying circumstance that Professor Kennedy has already recommended the system of gas-engine sub-stations to the Corporation of Belfast; and he devoted a good deal of pains to prove his point that in this direction lies the hope of electricians for deliverance, not only from the excessive cost of storeage, but also from that of distribution by underground wires. This part of the address, while undoubtedly rather heavy in the delivery, is far and away the cleverest portion of the composition, and does the most credit to the author. Electricians are very prone to accuse gas engineers of stupidity, and of ignorance of what is going on around them. Perhaps they will take the trouble to make Mr. Denny Lane's masterly exposition fit in with this convenient delusion.

Unfortunately for the completeness of the President's demonstration of the truth that distribution of gas means distribution of power, with all the consequences and fruits of this proceeding, we have to bear in mind that gas power stations are yet only available for satisfying comparatively small requirements. He speaks of what can be done in this way with "even a small plant," comprising three 16-horse power gas-engines. But the thing to be remembered is that in such a station gas power is practically at its best. There are many small towns, and small sub-centres of large towns, where a group of gas-engines in a convenient cellar would supply all the electric lighting required. But when we come to deal with anything like a connection, gas power falls very short of meeting the necessities of the case. Who is there that wants upwards of 100-horse power for lighting or any other purpose, who will use gas-engines supplied with ordinary coal gas? It is all very well to talk of "heating gas" in this connection as an alternative; but when it is a case of setting up generators on the premises, there is no advantage over the steam-boiler on the score of labour-saving or cleanliness.

On the question of policy brought forward by the President—that "it is a pity that the electric light was not handed over to those who were already the purveyors of light to the public," meaning the gas manufacturers—we are directly opposed to him. It might be true that gas manufacturers could supply the light "on better terms than any separate organization;" but what advantage would this be to them or their statutory supporters? So far as Irish examples are concerned, the only instances of central station electric lighting ventures adduced by Mr. Denny Lane are shown by himself to be things that the local gas companies have done excellently well in leaving alone; and we rejoice that the hankerings of the Dublin and Cork Gas Companies after this "glittering snake" have been disappointed. Surely Mr. Denny Lane is as wise as the typically prudent American who, in his study of the effects of the bite of venomous reptiles, was quite content to "let the snake bite the other fellow."

The address was long; but, in the circumstances, this was a virtue. Nothing in it deserves the opprobrious name of "padding." The matter flows on naturally and easily—we might say, as a river from a full source, only that our dislike of metaphors is as strong as that professed, but only partially acted upon, by Mr. Denny Lane himself. Indeed, like Carlyle's love of silence, the President's admiration of simple speech is manifestly of a Platonic nature; for he ended his address with a peroration conceived in a highly florid style, and expressed in most mellifluous periods. But who would be so cruel as to hold an Irish orator to his professions of literary or rhetorical fancy? Not we, at any rate; our admiration of Mr. Denny Lane being far too profound to be disturbed by such little ruffles of criticism. Long may the talented and learned Secretary of the Cork Gas Company, twice President of the Incorporated Gas Institute, flourish and bear the fruits of wisdom for the delight and instruction of the younger generation, and be recognized throughout the three kingdoms, the whole English-speaking world, and even the European Continent, as the chief orator of the universal gas industry! Take him for all in all, he is unique, unparalleled, and unapproachable.

As was only to be expected after the somewhat exhausting meeting of the morning, the attendance on Tuesday afternoon was smaller. The weather was very fine and hot (as indeed it remained during the whole week); and the attractiveness of the papers contributed by Mr. J. Lyne, of Wexford, and Mr. T. Travers, of Cork, was hardly strong enough to compete with the many out-of-door engagements which the members of the Institute were not only invited, but actually encouraged to make. There was a lengthy discussion upon the papers, noticeable for the number of new men who took part in it; and it may be suggested that any members who have regulations in force with regard to internal fittings might send copies to the Secretary, in order that these may be published with the official report of the discussion.

All Wednesday morning was practically given up to Professor Vivian B. Lewes, whose lecture and paper—both delivered in capital style—were very well received. It may be remarked here that, while the Institute were under a great obligation to the Corporation of Belfast for granting the use of the Council Chamber for the meeting, the acoustic properties of this apartment, and the condition of the street pavement outside, left much to be desired; and only speakers of considerable lung power and practice in public oratory succeeded in making themselves heard in it. Wednesday afternoon was devoted to visiting works, &c., in and about the city. A large party went over the Harland and Wolff shipbuilding yards, where at present 9000 hands are stated to be employed. The kindness of the firm in permitting such a large number of strangers to inspect their works deserves recognition, particularly when it is borne in mind that the interference with work unavoidable in connection with such visitations means a considerable loss of time and money. Other parties went to the gas-works; and also to the new sewage-pumping station, under the direction of Mr. Muntz, who throughout the week worthily seconded the efforts of Mr. Stelfox to provide entertainment for the members and their friends. Indeed, the kindness of all the Corporation officials was conspicuous, and went a long way to further the success of the meeting.

Thursday was devoted to the papers of Messrs. E. Bryan Donkin, Terrace, and Emerson Dowson, all of which were amply discussed. After so much talking upon subjects so engrossing as the right way to govern gas exhausters, the advantages of sloping retorts, and the interest of gas companies in gas-engines, there was little time left for the transaction of the routine business incidental to the winding up of one annual meeting, and making the necessary preliminary arrangements for the next. When it is said that Mr. John West, of Manchester, was chosen President, and that London was selected as the place of meeting, it is unnecessary to state anything more in this regard. It should be mentioned, in connection with the retirement of Mr. W. H. Harvey, the late Secretary of the Institute, that the Council agreed to present him with an illuminated address, testifying to their appreciation of his character and services; and this was done as part of Thursday afternoon's business.

The excursion to Portrush and the Giant's Causeway on Friday was well patronized and apparently much enjoyed, although it must be confessed that the carrying out of the long programme meant a hard day's work at the task of enjoyment.

REPORT OF PROCEEDINGS.

The Thirtieth Annual General Meeting of the Institute was held on Tuesday, Wednesday, and Thursday of last week, in the City Hall, Belfast, under the presidency of DENNY LANE, Esq., M.A., the Secretary of the Cork Consumers' Gas Company.

AN OFFICIAL WELCOME TO THE INSTITUTE.

Previous to the commencement of the business on the first-named day,

Sir D. DIXON, the Lord Mayor of Belfast, on behalf of the Corporation, welcomed the Institute to the city. He said it gave him great pleasure to do so on the occasion of its thirtieth annual meeting; and he was gratified to hear that the number of the members was increasing. The papers read and discussed must greatly help the development of gas manufacture; and the interchange of ideas

by men thoroughly acquainted with the subject must also tend strongly in the same direction. It might be interesting to the members to know that the Corporation of Belfast became the owners of the gas-works in 1874, at a cost of £432,000; the output of gas being then 416 million cubic feet. The rapid growth of the city necessitated a great increase in the works; and a sum of £300,000 was now being spent upon them. The output at present was 1136 million feet, or nearly three times that of 1874. There was no doubt that the success of the gas undertaking was greatly due to the energy of Mr. J. Stelfox, their able Engineer and Manager. He concluded by expressing a hope that the visit of the Institute to Belfast would be both pleasant and profitable.

The PRESIDENT, on behalf of the Institute, expressed their most sincere acknowledgments to the Mayor and Corporation for the very kind reception accorded to them. They were, no doubt, much indebted to the good offices of Mr. Stelfox, who was so well known and so highly respected in Belfast; but his introduction had been very kindly received by the Corporation, who had placed at their disposal, for the purpose of the meeting, the handsome room in which they were assembled.

The LORD MAYOR, having thanked the President, and repeated his assurance that the Corporation had great pleasure in placing the hall at the disposal of the Institute, retired.

CONFIRMATION OF MINUTES.

The minutes of the previous meeting were taken as read.

Mr. W. SMITH (Hyde) moved their adoption.

Mr. W. S. HADDOCK (Warrington) seconded the motion; and it was carried unanimously.

APPOINTMENT OF SCRUTINEERS.

Mr. J. DAVIS (Gravesend) and Mr. J. LOWE (Weymouth) were appointed Scrutineers of the ballot-papers.

ANNUAL REPORT AND ACCOUNTS.

Mr. G. HELPS (Bath) moved the adoption of the annual report of the Council, which was given in the JOURNAL last week.

Mr. T. BOWER (West Hartlepool) seconded the motion; and it was unanimously agreed to.

Mr. W. R. COOPER (Banbury) moved that the statement of accounts be received and adopted. He remarked that the figures did not look quite so flourishing as he should like to see them; but he hoped the day was not far distant when the Institute would recover its position.

Mr. J. CHADWICK (Oldham), in seconding the motion, said the expenses had been far in excess of the receipts; but there might be two reasons for this. He trusted that during the coming year the Council would be able to reduce the expenditure, and make it commensurate with the revenue. He noted that the cost of printing the Transactions had been considerably in excess of what it was previously; and there were one or two other items which he did not like to see so large. For instance, there was "Subscriptions written off, £44 17s.," which was not very satisfactory, following on an item of £121 under the same heading last year. On the other hand, the unpaid subscriptions represented a considerable amount; and he felt sure that, if gentlemen would only remit a little earlier, it would greatly facilitate the work of the Council and the Secretary, and save expenditure in postage.

Mr. J. HEPWORTH (Carlisle), in supporting the motion, said there was good reason to believe that during next year there would be a considerable reduction in the expenditure. As most of the members were aware, the amount spent had been somewhat exceptional for two or three years past. But this had happily come to an end; and he believed that, by the time they met next year, they would be able to show a very different condition of things to what was revealed in the present statement, which, though not so favourable as the members would like to see, was yet one of the most hopeful they had had for a long time. They were certainly "out of the wood;" and the expenses would this year be so much reduced that there was every prospect of a return to the former position.

The motion was then put, and carried unanimously.

PREMIUMS FOR PAPERS.

The PRESIDENT next called upon Mr. A. T. Walmisley, M.Inst.C.E. (London), to come forward and receive the President's Medal and a cheque for £10, being the first premium, for his paper read at the last meeting, on "The External Vertical Standards of Gasholder Framework." He remarked that on a former occasion he was placed in the embarrassing position of having to present a medal and cheque to himself; but, fortunately, Mr. Walmisley had come forward to relieve him to-day from one-half of that dual position.

Mr. WALMISLEY said he could not accept the handsome medal and the cheque accompanying it without tendering his best thanks for the kind manner in which his paper had been received and appraised. When he first sat down to write it, he had no idea it would prove worthy of such an award; and, indeed, he had grave doubts whether it would be worthy of being offered to the Institute at all. But he was encouraged by his kind friends, Mr. Hepworth and Mr. Valon, to go on with it; and he found that his interest in the subject grew in proportion as he gave it thoughtful consideration. He believed many members, who were diffident about undertaking the preparation of a paper, would, if they only set about it, find it labour well spent; and, if they met with such a reward as he had, they could not fail to be highly gratified.

The PRESIDENT then presented the second premium to Mr. W. R. Chester (Nottingham) for his paper on "The Structural Capacity and Cost of Gas-Works."

Mr. CHESTER having expressed his acknowledgments,

The PRESIDENT announced that the third premium had been awarded to Mr. T. Newbigging (Manchester), who he regretted to say, was unable to be present, owing to the pressure of parliamentary duties, for his second paper on "Difficulties in Tank Construction."

PRESIDENT'S ADDRESS.

The PRESIDENT then delivered his Inaugural Address, which was given in the JOURNAL last week (p. 1086).

Mr. J. STELFOX (Belfast) moved that the best thanks of the Institute be accorded to the President for his address. He said it was not often that much eloquence was to be found in a technical paper or address. The members had, however, been accustomed to look for this quality in Mr. Lane's productions; and, on the present occasion, he had fully sustained his reputation. He (Mr. Stelfox) did not propose to refer to the address in detail, but no doubt it would be read with great interest by those who were not able to be present; and it would be re-read by those who had heard it. It would furnish matter for thought to everyone; being a most able exposition of the present position of gas and electricity.

Mr. W. A. VALON (Ramsgate) said he had great pleasure in seconding the motion. This was the second time they had had the gratification of listening to the eloquent language and rounded periods of Mr. Denny Lane as their President; and he hoped they would hear his voice among them for many years to come. Ten years ago, at the Crystal Palace, he astonished them all by the extent of his knowledge on the subject of electricity. He had now brought it forward again, and treated it in a manner which he (Mr. Valon) was sure would induce them all to give more attention to this matter; for in future it must be included in the education of every gas manager.

The motion having been carried by acclamation,

The PRESIDENT, in briefly acknowledging the vote, said he feared he had been rather tedious; but, thinking the address would be more useful when read than when listened to, he had gone more into detail than he otherwise should have done.

ELECTION OF A MEMBER.

Mr. HEPWORTH said there was a proposal for membership which had somehow been accidentally omitted from the ballot-list—from Mr. Outon, of Dublin; and he suggested that this gentleman should be elected.

The PRESIDENT having spoken of Mr. Outon's services to the gas industry, in his official position in connection with the Great Southern and Western Railway of Dublin,

The name was submitted to the members, and accepted unanimously.

The meeting then adjourned for luncheon.

READING OF PAPERS.

On the resumption of the proceedings in the afternoon, the reading of papers was commenced, and was continued

on the next and the succeeding day. They were taken in the following order:—

Tuesday.—(1) "On Gas-Fittings and their Supply by Gas Undertakings." By J. Lyne, of Wexford. (2) "Gas-Burners—A Suggestion." By T. Travers, of Cork.

Wednesday.—(3) "On the Enrichment of Coal Gas." By Vivian B. Lewes, F.I.C., F.C.S., of Greenwich.

Thursday.—(4) "On Rotary Engines and their Application for Gas Exhausting." By E. Bryan Donkin, of London. (5) "On the Setting and Working of Inclined Retorts at Middlesbrough." By David Terrace, of Middlesbrough. (6) "On Gas Power." By J. Emerson Dowson, of London.

The first three papers, together with the lecture delivered by Professor Lewes on the second day of the meeting, entitled "Gas Lighting and Ventilation," will be found in another part of the Journal to-day. The remainder, with the report of the discussions, will be given in subsequent issues.

Report of the Scrutineers.

The result of the election of office-bearers for the ensuing year was as follows:—

President.—John West, of Manchester.

Vice-Presidents.—R. Mitchell, of Edinburgh; T. O. Paterson, of Birkenhead.

New Members of Council.—J. Braddock, of Oldham; N. H. Humphrys, of Salisbury; J. Stelfox, of Belfast; and H. Tobey, of Malton.

Auditors.—T. W. R. White, of Sherborne; Alfred Lass, F.C.A., of London.

Hon. Secretary.—J. Hepworth, of Carlisle.

Mr. West said he felt it a great honour to be elected President. He had no doubt he should fail in many things; but, with the kind assistance which had been offered him, he would do the best he could. During the past year, having suffered from a serious accident, he thought he should have to give up even the Vice-Presidency; but he was glad to say he had been gaining strength, and hoped to be able to attend to the duties devolving upon him.

New Members.

The Secretary read the following list of new members and associates, and of those transferred to the class of members:—

Members.—Anderson, G. W., Caterham; Carr, J. W., Johannesburg; Duxbury, J., Windermere; Elton, A. W., Matlock Bath; Fairweather, W., Kilmarnock; Gibson, B., Haverhill; Green, W. H., Bournemouth; Griffin, J., Fareham; Hamilton, H., Chertsey; Harris, J. A., Great Wigston; Lanyon, S. H., Redruth; Lord, T., Geelong (Australia); Love, G. R., Dundalk; Newton, C. B., Rotherham; Porter, R., Elland-cum-Greetland; Sapey, W. A., Tamworth; Shadbolt, R. G., North Bierley; Smith, J. C., Denton; Simmonds, H., Colne; Thomson, J., Inverness; Thomson, R. B. H., Broughty Ferry; Tully, C. B., Sligo; Vivian, F. G., Llanelly; Walker, G., Wantage.

Associate Members.—Glover, T., Carlisle; Johnston, F. W., Bristol; Langford, W., Bath; Niven, H., Clayton; Sainsbury, W. H., Salisbury; Surman, W., Bath.

Associates.—Bale, A. J., London; Clayton, L., Hunslet; Donkin, E. B., London; Spencer, S., London.

Transferences.—Associate Members to Members: Bamsey, W. S., Hong Kong; Hall, L. G., Rhyl; Pooley, H., Dunfermline; Ritson, T. N., Kendal.

Benevolent Fund.*

The President said Mr. T. T. Marks, of Llandudno, and Mr. B. Green, of Mitcham, had been elected on the Committee of this fund; and he might take the opportunity of saying that he thought it a great pity that a larger number of the members did not subscribe to it. The means at the disposal of the Committee were at present very small; but some of those on whom the sun was shining that day might be in a very different position at some future time, and they or their families might require assistance. They all knew that when the sun shone was the time to make hay; and he hoped the members would bear this in mind, and subscribe to this very useful fund.

*The proceedings at the meeting of the subscribers to this fund are reported later on.

An Honorary Member.

The President said he had now to propose that the President of the Société Technique du Gaz en France be elected as an honorary member. He had received the greatest kindness from that body; and immediately after he was chosen President of the Institute, he was elected an honorary member, and ever since had received annually a copy of their very valuable Transactions. Two years ago he had the pleasure of meeting the members in London, when he was invited, with some other representatives of the Institute, to dine with them; and he had the audacity to make a speech in French. He had much pleasure now in moving that their kindness should be reciprocated by electing their President an honorary member. A short time ago he received an invitation to join a banquet of the Society in Paris; but he had to decline, as the day fixed was the same as that of the present meeting. Their President, in reply, suggested that, in future, arrangements would be made that the two meetings should not take place simultaneously.

The motion was carried unanimously.

Place of Next Meeting.

The President said that it was usual to meet every alternate year in London; and he presumed the members would adhere to established precedent.

This was unanimously agreed to.

Votes of Thanks.

The President moved a sincere vote of thanks to the Lord Mayor and Corporation of Belfast, for the cordial reception given to the members, and for having kindly granted the use of the City Hall for the meetings.

Mr. Hepworth, in seconding the motion, said he had had the pleasure of visiting Belfast more than once before, and therefore he knew the hospitality which characterized the inhabitants; but the hearty and zealous way in which all the requirements of the members had been anticipated was more than anyone could have expected.

Mr. Hutchinson supported the motion; saying he was sure the Lord Mayor would never regret having given the Institute his official recognition and support.

The vote of thanks was carried unanimously.

The President next proposed a vote of thanks to Mr. Stelfox, for having so kindly undertaken all the general arrangements of the meeting. He said he did not know why they should thank a gentleman for doing what was a source of pleasure to himself, which he was quite sure this was to Mr. Stelfox. Still it was a pleasure that was not attained without a good deal of labour; and he attributed to the excellence of Mr. Stelfox's arrangements the fact that everything had passed off without a single hitch.

Mr. W. R. Chester (Nottingham) said he had much pleasure in seconding the motion. The genial good nature of the gentleman referred to, and the high esteem in which he was held, not only in Belfast, but throughout the gas world, rendered his services the more valuable; and the Institute was to be congratulated that he had consented to act on the Council for the coming year.

The motion was carried unanimously.

Mr. Stelfox, in response, said the determination of the Institute to come to Belfast at first rather alarmed him, for, having regard to the elaborate preparations which had been made in other places for the entertainment of members, he feared they might not be able to keep up the pace, and that some would go away disappointed. Indeed, some other friends had suggested that the meeting was hardly worth coming for. However, it certainly had been a great pleasure to him to further the desires of the Council to make the gathering as acceptable as possible.

Mr. Hutchinson here pointed out that the date of the next meeting had not been fixed.

The President suggested that it would be well to leave this in the hands of the Council, especially having regard to the desire expressed by their French brethren that the two meetings should not be allowed to clash.

Mr. R. Mitchell (Edinburgh) moved a vote of thanks to Messrs. Harland and Wolff, and to the other firms in Belfast who had so kindly thrown open their works to the inspection of members.

Mr. Simpson seconded the motion, which was at once carried unanimously.

Mr. C. Wood (Bradford) moved a vote of thanks to the authors of the papers. He said they could not always

agree with everything submitted; but none the less they were indebted to the authors for bringing forward their views for discussion. He came to the meeting in some trepidation as to its success, in consequence of what some of their friends had said about it; but he was glad his fears had all been dispelled. It was much better to have a few good papers, and have them amply discussed, than to have a larger number hurried over, or taken as read.

Mr. T. Duxbury, in seconding the motion, referred to the immense amount of time and trouble which must have been taken in preparing some of the drawings.

The President, in putting the motion, referred to what had been alluded to by Mr. Wood; and said that, as everything had gone off so well, they were all prepared to smile at it.

The motion was carried unanimously.

Mr. Braddock moved a vote of thanks to the Scrutineers.

Mr. Ritson seconded the motion; and it was carried.

Mr. J. H. Troughton (Newmarket) moved a vote of thanks to the Auditors.

Mr. W. Fergusson (Barrow) seconded the motion, which was also carried unanimously.

Mr. W. Ford (Stockton) moved a vote of thanks to the Council of the Institute for their services. Though he quite concurred in all that had been said in favour of the Lord Mayor and Corporation, and of Mr. Stelfox, he would remind the members that, unless they had a Council who were devoted to the interests of the Institute, and continually at work for it, it would soon lose the position it held at the present time. He was very glad that the Institute had met for the second time in the country which was his adopted home for some years, and which he was much pleased to have the opportunity of re-visiting.

Mr. W. Duff (Morecambe) seconded the motion, which was carried unanimously.

The President here left the chair, which was temporarily filled by the President-Elect.

Mr. West said he had to propose a resolution which was to have been moved by Mr. Valon; but that gentleman had been called away. It was an easy matter, however, to ask the members to pass a vote of thanks to the President for his valuable services during the past year, as well as for his practical and scientific address, and for the extremely able way he had conducted the whole business of the meeting. He (Mr. West) had attended a great many, but never remembered any which had been more successful; and no small amount of this success was due to the ability, kindness, and judgment of the President.

Mr. J. M'Gilchrist (Dumbarton) seconded the motion. The President had, he said, delighted them all by his presence, his scientific attainments, and his ready wit, both in that hall and at their social gatherings; and they would all join in congratulating him on the excellent way in which he had discharged the duties of his office.

The motion having been carried by acclamation,

The President, in responding, remarked on the strange fact that an Englishman had proposed, and a Scotchman had seconded, a vote of thanks to an Irishman for keeping order. When the crown was put upon him for the second time, he was so much assisted, and so warmly welcomed, by his colleagues, that he thought perhaps, after seven years more, if they proposed that he should be like the Pope and receive the triple crown, he should be prepared to consider the question. It had given him very great satisfaction to meet the members in the industrial capital of Ireland, and to find that everything had passed off satisfactorily. He could only say, in conclusion, that he had been met with a smile of welcome by the members whenever he met them—showing a kindly feeling towards him, which he heartily returned.

Testimonial to Mr. Harvey.

Mr. Hepworth said the members would remember the clause in the annual report referring to the resignation of Mr. Harvey, the former Secretary, in accordance with which he now produced a vote of thanks to him, handsomely engrossed on vellum, and illuminated. It was worded as follows:—

Incorporated Gas Institute.

At a meeting of the Council of the Incorporated Gas Institute held in London on April 8th, 1893, it was unanimously resolved that the best thanks of this Council be awarded to Mr. William H. Harvey, B.A., on his retirement from the office of Secretary of this Institute—an office which he has filled with the greatest satisfaction to the Council and the members during the past three years, and in retiring from which he takes with him their esteem and confidence, with their good wishes for his future prosperity.

Signed, on behalf of the Council,

Denny Lane, M.A., President.
J. Hepworth, Hon. Sec.

Mr. Harvey severed his connection with them with many regrets; but he did as most would do under similar circumstances—he accepted an appointment which seemed to present, and which he (Mr. Hepworth) hoped would realize to him, much better pecuniary advantages than the Institute could ever hope to offer their Secretary. He might add that the testimonial was the work of a Belfast artist, and had been executed by Messrs. Marcus Ward and Co. since the first day of the meeting. He would now confide it to Mr. Burfield, to hand to his predecessor in due course.

Mr. J. Timmins (Wigan) proposed, and Mr. Harry Wimhurst (Sleaford) seconded, a vote of thanks to the Secretary.

The President, in putting the motion, testified to the accuracy and promptitude with which the Secretary had fulfilled his duties.

The motion having been carried unanimously,

Mr. Burfield briefly responded; saying he hoped, as the members came to know more of him, they would be more and more satisfied that the secretarial work was in good hands.

Mr. C. S. Ellery (Bath) said there was one gentleman who had not been thanked, though he deserved it as much as anyone—viz., Mr. Hepworth, the Hon. Secretary. He had stepped into the gap again and again; and his genial manner and courteous conduct endeared him to all with whom he came in contact.

Mr. J. Hammond (Eastbourne) seconded the motion, which, after a few words from the President, was carried unanimously.

Mr. Hepworth said he was indebted to the Institute for many acts of kindness; but this was one which he had not anticipated. However, it only increased his desire to do all in his power to promote its interests, which he hoped to be able to do for some time to come.

The proceedings then closed.

The Excursion.

On Friday, the members, with a large number of lady friends, visited the Giant's Causeway; travelling by rail to Portrush, where luncheon was partaken of in the large dining-room adjoining the station, which commands a fine view of the sea and the neighbouring coast. Thence the journey was completed by the electric tramway; a portion of the cars, however, being drawn by the old-fashioned agency of steam locomotives, which seem to play a considerable part in the working of this electric tramway. Short stoppages were made at various points *en route*, to give the visitors an opportunity of admiring the more striking portions of the coast scenery. On arriving at the Causeway, some of the visitors descended to the shore, and explored the immediate vicinity and some of the caves in boats; while others, under the guidance of Mr. Stelfox, walked a short distance over the headlands, in the direction of the Pleaskin Head, and, on returning, reached the Causeway by a precipitous pathway down the face of the cliff. The various points of interest in and about the Causeway having been inspected, the whole party were photographed in a group by Mr. Welch, of Belfast, before returning to Portrush. Here an excellent dinner was served, at the conclusion of which Mr. West, the President-Elect, proposed the health of his predecessor in office. Mr. Denny Lane acknowledged the toast in one of those characteristic speeches which do so much to make and keep him popular with the members. He concluded by proposing the health of Mr. Stelfox, which was suitably responded to by that gentleman. After drinking the health of the ladies, the party returned to Belfast highly delighted with the day's excursion. The weather was magnificent, though its warmth ran that of Irish hospitality very close indeed.

BENEVOLENT FUND.

The Annual Meeting of Subscribers to the Benevolent Fund was held at the conclusion of the ordinary business of the Institute on the opening day—the President occupying the chair.

The minutes of the last meeting having been read and confirmed, the following report of the Committee of Management was read:—

"The Committee of Management of the Benevolent Fund of the Incorporated Gas Institute beg to report as follows.

"During the year ended the 31st of December., 1892, subscriptions were received to the amount of £38 6s. 6d., together with donations £12 12s. The investments produced dividends of £59 12s. 8d.; making, with the foregoing subscriptions and donations, a total income for the year of £110 11s. 2d. On the other side of the account, the sum of £50 was expended in grants to the various cases which came before your Committee for assistance; these cases being six in number. The sum of £5 9s. 2d. was expended in travelling expenses of the Committee; making, with 19s. 8d. for printing and postage, a total expenditure during the year of £56 8s. 10d.

"The members of the Committee who, in accordance with Rule 12, retire this year are Messrs. T. T. Marks and B. Green. These gentlemen are willing to serve again for another term of office; and, being eligible for re-election, their names have accordingly been entered on the balloting-lists issued to the subscribers and donors to the fund.

"With a view to carrying out efficiently the object of the Benevolent Fund as defined in the rules, the Committee will be glad if members and other contributors will kindly submit particulars of any deserving cases fulfilling the necessary conditions, which come under their notice."

Mr. W. W. Hutchinson (Barnsley) moved the adoption of the report.

Mr. J. Hepworth (Carlisle) seconded the motion. He expressed regret that the suggestion made by Mr. Ellery at the last meeting was not carried out, and the report they had just heard was not read at the meeting of the Institute. He must say that, in his opinion, the Benevolent Fund was being neglected. He intended to subscribe last year, but did not do so, simply because his annual subscription to the Institute went direct from the bank at the beginning of each year, and he received no reminder about a subscription to the Benevolent Fund. He had subscribed in a way by means of a donation when the fund was instituted. But he should like to extend the little help he could give by sending an annual subscription; and if the Committee who had charge of the fund would be good enough to look up the matter during the next year, he could promise them that they would find a very substantial increase in the fund would take place. It was a fortunate circumstance that the claims on the fund had not hitherto been greater than the Committee were able to meet. There was, however, an increase in the number of applicants for assistance, which would have to be dealt with by the Committee at their next meeting; and, from what he knew of the last case which had come in, he might say that the circumstances were such that a very much larger sum than was given to the applicants last year could be very well expended in affording relief in this case. On many grounds, therefore, there was reason to hope that the Committee would do all they could to increase the income of this valuable fund.

The motion was put, and carried unanimously.

The statement of accounts, as printed and circulated, was taken as read; and, on the motion of Mr. Valon, seconded by Mr. Simpson, was adopted.

This concluded the business; the retiring members of the Committee having consented to serve again.

The Committee afterwards met to consider various applications for assistance.

THE LECTURE.

GAS LIGHTING AND VENTILATION.

By Vivian B. Lewes, F.I.C., F.C.S.,

Professor of Chemistry at the Royal Naval College, Greenwich, Chief Gas Examiner to the Corporation of London.

The subject of gaseous illumination and ventilation has been so often brought before the Institute, that I fear the title I have chosen will conjure up in your minds the idea that I am about to spend the time allotted to me in a dissertation on various forms of ventilating burners, and their action upon the air of our gas-lighted rooms. Nothing, however, is farther from my intention than this; and if you will bear with me for a short portion of the time whilst I lay the foundation of my subject, I hope I shall be able to bring before you some considerations which will be new to many present.

Most of my experimental work has been done with the gas supplied by the London Companies, the present composition of which is shown in the following analyses:—

Composition of London Gas, May 26, 1893.

	South Metropolitan Gas Company.		The Gaslight and Coke Company.
Hydrogen	50·16	..	53·36
Unsaturated hydrocarbons	3·50	..	3·58
Saturated hydrocarbons	36·25	..	32·69
Carbon monoxide	5·68	..	7·05
Nitrogen	4·10	..	2·50
Carbon dioxide	0·00	..	0·61
Oxygen	0·31	..	0·21
Sulphuretted hydrogen	nil	..	nil
	100·00		100·00
	Grains per 100 Cub. Ft.		Grains per 100 Cub. Ft.
Ammonia	0·6	..	0·2
Sulphur compounds	12·0	..	10·5

And 100 cubic feet of these gases will yield on complete combustion—

	Cub. Ft.		Cub. Ft.
Carbon dioxide	56·0	..	51·0
Water vapour	140·0	..	134·0
Sulphur dioxide	0·0192	..	0·168

The volumes of carbon dioxide given were experimentally determined; and the slightly higher result yielded by the South Metropolitan Company's gas is due to the presence of some of the higher saturated hydrocarbons, probably from enrichment by the Maxim-Clark process.

Combustion, however, in ordinary burners is never absolutely complete; and even with a 16-candle gas, very slight traces of carbon monoxide will generally escape combustion, whilst with a rich gas distinct traces of acetylene are also given off. In any ordinary room, however, the quantities of sulphur dioxide and the products of incomplete combustion are so minute that it is almost impossible to detect them, and absolutely impossible to estimate them with any approach to accuracy—indeed, our senses are so much more delicate than our chemical reagents in detecting such contamination, that smell and brain will detect the vitiation long before a sufficiently large trace is present to give any satisfactory analytical results. We will first consider the action of the more important products of combustion—carbon dioxide and water vapour—on the atmosphere of a confined space, such as an ordinary room.

It is manifest that, in order to obtain any given amount of light, the volume of the gas consumed, and therefore the amount of vitiation produced, must entirely depend upon the form of burner used. On examining the burners in general use in most districts, it will be found that at least 90 per cent. of them are flat-flame burners of common construction, which have been purchased more with a view to cheapness than with any idea of developing the light-giving power of the gas consumed. The largest number of burners will be flat-flame burners of the size known as 4 and 5, which are popularly supposed to consume 4 and 5 cubic feet of gas per hour respectively, although, with the ordinary pressure of gas turned fully on to them, as is generally found to be the case, they will often consume nearly double this amount, and yield an extremely low quantity of light. In nearly every case where a Vestry or Corporation complain of insufficient illuminating power given by the public lamps, it will be found that this is due to the street-lamps being fitted with cheap burners, of a kind absolutely unsuitable for the gas, and also to the pressure not being properly regulated. With the hollow-top flat-flame burners manufactured by an English maker of repute, and with the gas supplied to it at a proper pressure, it is possible to obtain as much as 3-candle power for every cubic foot of gas consumed; whilst it is quite possible to find burners in many London lamps, which appear identical in construction, yielding only 1-candle power per cubic foot of gas consumed. The whole secret of this enormous difference is that the burners have been made at a cheap rate in Germany, without any idea of the quality of gas to be burned, and have had the slits made far too narrow, so that the admixture of too large a proportion of air during combustion has practically destroyed two-thirds of the luminosity—such burners only holding their own in the market on account

of the low price at which they can be obtained. There is no doubt that, if Vestries and Corporations were to leave the selection of the burners to the Gas Companies, or else take the advice of competent experts upon the class of burner which it would be most economical to use with gas of the quality supplied, the increase in illuminating power would soon more than pay for any extra expense which might be entailed.

As regards consumption of gas in private houses, it will be found that nearly all the nipples used are No. 4 or No. 5; and, in experimenting with the gas supplied in the City, which has an illuminating value giving an average of 16·5 candles, these burners yield results which compare most unfavourably with the light obtainable from the consumption of the gas either in Argand or in regenerative burners.

Service Yielded by Ordinary Burners Consuming 16·5-Candle Gas.

Burner.	Illuminating Value per Cubic Foot of Gas.
Flat-flame, No. 6	2·5 candles
„ No. 5	2·1 „
„ No. 4	1·9 „
London Argand	3·3 „
Regenerative	10·0 „

It must also be borne in mind that the universal use of such unsuitable burners not only means enormous waste of gas—a consideration not at all likely to worry the gas manager—but it also entails a very great increase in the vitiation of the atmosphere of our dwelling-rooms, which means encouraging the demand for electric lighting. It is usual to gauge the amount of vitiation in the atmosphere of a room by the percentage of carbon dioxide present; and although this is by no means an accurate index of the absolute action of such air upon health, yet it affords a rough-and-ready indication which is sufficiently near the truth for ordinary purposes. Taking now a large dining-room, which would require an amount of light equal to (say) 48 candles, the following table will show the amount of 16-candle gas consumed, and the volume of carbon dioxide generated per hour in producing it; whilst to make the meaning clearer, I have added the number of adults who would exhale the same amount of carbon dioxide in the same time.

Gas Consumed and Carbon Dioxide Produced to Yield an Illumination equal to 48 Candles.

Burner.	Gas Consumed.	Carbon Dioxide Produced.	Adults.
Flat-flame, No. 6	19·2	10·1	16·8
„ No. 5	22·9	12·1	20·1
„ No. 4	25·3	13·4	22·3
London Argand	15·0	7·9	13·1
Regenerative	4·8	2·5	4·1

I think this method of stating the case brings out in a startling way the importance of giving more attention to our methods of gas consumption; but I must also point out that, although the use of regenerative burners would reduce the amount of vitiation to one-fourth or even one-fifth, yet too much blame must not be put on the gas. If we obtained the same amount of light from paraffin lamps, the carbon dioxide evolved would be equivalent to 22·5 adults; whilst you might as well invite 32·7 more guests to dinner, as use 48 sperm candles to supply the needed illumination.

Leaving this phase of the question, let us now examine the atmospheric condition of an ordinary sitting-room, without any special means of ventilation other than those supplied by the usual door, fire-place, and window. An average sample of 16-candle gas will evolve 50 cubic feet of carbon dioxide for every 100 cubic feet consumed; and in an ordinary sitting-room, 12 feet broad by 16 feet long and 12 feet high, an ordinary 3-jet chandelier would take five hours to consume this quantity. If there are two people in the room, they will have exhaled 6 cubic feet of carbon dioxide during this period, making the total volume of this gas generated during the five hours up to 56 cubic feet. The capacity of the room is 2304 cubic feet; so that this amount will represent 2 per cent. But when one experimentally determines the amount actually present, one finds that, under the conditions stated, the 3 feet next the ceiling contain 0·4 per cent. of carbon dioxide; the next 3 feet only 0·2 per cent. and the 6 feet nearest the floor, an average of 0·07 per cent. That is to say, the total amount of carbon dioxide present only amounts to 0·18 per cent. of the air present, or less than one-tenth of the gas evolved—showing that the total air of the room has been changed at least twice an hour during the period in which the gas has been burning. In these experiments the door was kept as far as possible shut; and the ventilation was therefore practically due to the fire-place, faulty work, and diffusion through the walls and ceilings.

If I might be allowed, I should like to mention at this point the question of the alleged injurious effects produced by sulphur compounds in coal gas. A short time ago I had the honour of corroborating Dr. Odling's evidence given in support of the Crystal Palace District Gas Company's Bill, to the effect that an increase in the sulphur compounds allowed in the gas from 20 up to 30 grains per 100 cubic feet would not practically cause any injury to the consumers; and this seems to have roused the ire of certain gentlemen in Manchester, who, having been brought up in the belief that sulphur is the root of all evil, felt that this was rank heresy. I am glad, therefore, to have the opportunity of stating the reasons which led me to the conclusion I came to on the subject.

I have already described an experiment to show that, in an ordinary room, nine-tenths of the products of combustion are removed without any special appliances. For every 100 cubic feet of gas containing 20 grains of sulphur consumed, there would be formed 0·032 of a cubic foot of sulphur dioxide; whilst with 30 grains, the amount would be raised to 0·048. This, except under very exceptional circumstances, would be reduced in quantity by ventilation in nearly the same ratio as the carbon dioxide; and the total volume of sulphur dioxide due to the combustion of the gas would be reduced to so minute a trace that it is beyond the power of ordinary analysis to accurately estimate it—the probable quantity being roughly 1-10,000th of 1 per cent., or 0·0625 of a grain of sulphur as sulphur dioxide per 100 cubic feet of air.

The view which has always been put forward is that the sulphur dioxide generated by the burning of the sulphur compounds does not diffuse with the other products of combustion, but becomes at once converted into sulphuric acid by combining with the moisture and oxygen present in the atmosphere; but experiment shows that it is only under special conditions, never likely to be arrived at in a room in which gas is burning, that this could possibly take place. If dry sulphur dioxide and dry oxygen be mixed together, even in an undiluted condition, they will remain without any action taking place. If water vapour be present, no reaction will occur unless the water vapour condenses into liquid drops. I have had mixtures of sulphur dioxide and moist air standing for long periods, without the slightest contraction taking place, proving conclusively that no formation of sulphuric acid could have occurred;* and, inasmuch as the condensation in the moisture of the air of a room can only take place when the saturation point of the air is reached, it is manifest that the percentage of water vapour present in the atmosphere will play a very important part in determining the action.

The percentage of water vapour in the air of a room in which gas is burning is found to be highest near the ceiling, and to decrease the lower one comes in the room; but it is not the percentage of moisture which determines the deposition of liquid water from the air, but the degree of saturation—*i.e.*, the power which the air has of holding up the water vapour—a factor which increases with great rapidity with rise of temperature. Experimenting in the same room in which the previous determinations were made, it was found that near the ceiling, at the end of the five hours during which the gas was burnt, the degree of saturation was 40 per cent.—that is to say, the air could have taken up, or held as a vapour, 60 per cent. more moisture than it possessed—whilst near the floor, the degree of saturation amounted to 78 per cent., or, in other words, it could only have taken up 22 per cent. more water vapour. This condition shows that, at the temperature existing in the room, no condensation of moisture could take place unless the air came in contact with a cold surface, such as the window panes on a cold night, when the moisture would condense upon the glass. In this moisture, distinct traces of sulphuric acid would be found; whilst in the air of the room, which would be in contact with the draperies and furniture, and which would be inhaled by the inhabitants of the room, no conversion of the sulphur dioxide into sulphuric acid would take place, and the sulphur dioxide diffusing with other products of combustion would never practically rise above the minute proportion before stated.

* This has also been proved by Professor Harold B. Dixon, as well as by Mr. Vernon Harcourt.

In order to prove the deleterious effects of this hypothetical formation of sulphuric acid, certain observers have brought forward many experiments to show that, in passing the air through absorbing solutions, sulphates could be detected in the solutions in small and varying quantities. This, however, certainly does not prove that sulphates were present in the air, as directly the sulphur dioxide is absorbed by the liquid, the oxidation to sulphuric acid takes place with considerable rapidity; and it is this which has given rise to wrong deductions from the observed facts of sulphuric acid, either free or in combination, being found in wetted fabrics, or on moistened plates or liquid absorbents exposed to the air of rooms in which gas has been burnt, also on lamp-glasses and in ventilating tubes in towns where no limit is placed on the amount of sulphur present in the gas.

A very favourite argument, which has been employed in showing the amount of sulphuric acid present in the air, is the rotting action which the air in the upper part of a room has upon books and other articles of leather. But here again the main factor has been overlooked, and many other causes of error have crept in. Leather is a substance which has the power of absorbing moisture; and in doing so, the absorbed moisture will fix sulphur dioxide, and allow it to be converted into sulphuric acid, although only to a small extent. In this way traces of the acid are produced, and will in time undoubtedly act upon the leather; but the results which have been observed, and which have done duty on so many occasions, are a great deal more dependent upon the sulphur dioxide which is found in all town air than upon the sulphur dioxide produced by the gas. The researches of Dr. Angus Smith and Dr. Russell show conclusively that, in the air of the larger towns and their suburbs, there are very considerable traces of oxides of sulphur present, which have been formed from the iron pyrites present in the coal and coke consumed as fuel; and my reason for considering that it is the sulphur dioxide in the air, rather than the sulphur compounds which are present to a slightly larger extent in the products of gas combustion, are as follows: All observers have taken great trouble to prove that it is the leather on the upper shelves of a library which become the most affected; and whilst the gas is burnt in the room, these upper shelves are exposed to the air, which has the power of taking up something like 60 per cent. more moisture than the air in the lower portion, and, at the high temperature which exists, this results in the drying of the leather. When the gas in such a room is extinguished, the temperature in the upper portion of the room begins to fall. But diffusion and other processes of ventilation remove the products of combustion long before the condensing point of the water is reached; and, within twenty minutes of putting out the gas, the sulphur compounds will have fallen down to the normal quantity found in the atmosphere outside the room, whilst the air, owing to contact with the warm walls, ceiling, and furniture in the room, will still be far away from the condensing point of the water vapour. As the air becomes colder and colder, and gets nearly to the point of saturation, the leather begins to absorb rapidly the same amount of moisture which it had previously given up to the air under the influence of heat; and with this moisture, it also absorbs traces of sulphur dioxide which all our town air possesses. In my opinion, it is chiefly *this*, and not the sulphur dioxide from the sulphur compounds in the gas alone, which brings about the deleterious results; and it will be found, in any room in which the air is kept artificially heated for a certain period in the day, and is then allowed to cool down again, this same destruction of leather will ensue—whether or not gas be used as an illuminant in the room—and though sulphuric acid may do its share in bringing about this destruction, the alternate moistening and drying will do far more.

It has also been considered a proof of the formation of sulphuric acid from the products of combustion of gas containing sulphur compounds, that dust collected in a room in which such gas is being burnt contains small quantities of sulphates. But here again several important factors of error have been overlooked. The dust which is found in a room has not been formed in that room, but has filtered in from the outside air under the sashes and other openings; and it must of necessity contain sulphur compounds, which have been produced by the fixation of the sulphur compounds produced by the burning of coal and coke, and by the ammonia and other alkaline bases present in the air. An analysis of dust from rooms in which no gas has been burnt will also show the presence of these bodies in as large quantities as from the rooms in which gas has been consumed in very considerable volume. Dust collected in my study at Greenwich, in which gas is very freely burnt, gave 3·05 per cent. of sulphur as sulphates; while dust collected in an attic of a disused portion of the same building, in which there has never been a gas-fitting, gave 4·4 per cent. This mistake has been caused by the fact that rain-washed dust collected on exposed outside sills often contains only a small percentage of sulphur. The closeness and oppressive feeling which can be distinguished in a room not properly ventilated when gas is being burnt, it not due to the presence of sulphur compounds, but to carbon dioxide and to the traces of the products of incomplete combustion. It is also partly owing to the organic emanations from the bodies and lungs of the inhabitants of such a room being unable to rise into the zone of highly-heated air which exists above the gas-burners in the room, and so being kept down to the level from which the air for respiration is being drawn.

From the foregoing considerations I am very decidedly of opinion that the sulphur compounds given off from gas containing 30 grains of sulphur per 100 cubic feet, would be so infinitesimally greater than the traces obtained by burning gas containing 20 grains per 100 cubic feet, that it would be impossible to detect any difference in the action upon furniture and draperies exposed to it; while all the reliable evidence goes to show that minute traces of such oxides of sulphur have no deleterious effect upon health. My desire this morning, however, is not so much to dwell upon the sanitary aspects of ventilation, as upon the effect of want of ventilation upon the light emitted by flames.

In 1835 Wehrle, in a paper upon the conditions necessary for the combustion of a candle, made some observations upon the effect of vitiation and removal of oxygen from the atmosphere upon the burning of the candle; but he gave no details as to the effect upon its photometric value. Twenty-five years ago, Dr. Angus Smith, however, whilst experimenting upon the combustion of candles in badly ventilated places, made a series of observations of the effect of vitiation upon the photometric value, from which he came to the conclusion that the removal of oxygen during combustion, and the increase of carbon dioxide in the air seriously affect the light emitted, and also that the effect of the vapour of water in preventing combustion and lowering the illuminating value is very great.

On Nov. 14, 1889, Mr. John Methven read a paper before the Southern District Gas Association on "Photometry," which was not only remarkable for its intrinsic merit, but also for the large number of new points which it suggested in this important field of research. Among the many valuable questions dealt with in this paper, was the effect of atmospheric moisture upon the illuminating value of flame; and the fact that the smaller and feebler the flame, the greater was the loss of luminosity due to this cause. Mr. Methven, in a lengthy series of experiments, and with the temperature practically constant, found that candles gave, per 120 grains of sperm consumed, a light equal to 1·104 candles, as compared with a light of constant power—Methven screen; and that this was increased to 1·196 candles, when the air in which the candles were burning was dried. This difference in the light value he considered to be due entirely to the removal of moisture, as the temperature remained the same. He also found that, when air saturated with moisture at increasing temperatures is supplied to a flame, the light-value is rapidly diminished, so that between the temperatures of 50° and 75° Fahr., a diminution of 10 per cent. takes place in the light emitted by an Argand flame burning 5 cubic feet of gas per hour; whilst with a flat flame, a reduction of 11·2 per cent. occurred, and with a gas-flame from a 2-candle burner a loss of 13 per cent. was found within the same range of temperature. The greater loss observed with the flat flame and the small jet, Mr. Methven ascribes to the power of the different flames to battle with the aqueous vapour. These experiments were made by passing air from a gasholder through a leaden chamber over the surface of sulphuric acid, to dry it; whilst to saturate it, the sulphuric acid was replaced by water. At the end of the chamber was an upright tower, on the top of which the flame was burning—surrounded in the case of the 2-candle burner by a lamp chimney, and in the case of the flat flame by a glass globe.

During the summer of last year, I made a large number of experiments with the view of, if possible, finding out the extent to which the variations in the quantity of water vapour present in the air of a testing-station would be likely to affect the value ascribed to the gas; and as it seems probable that the standard candle may soon be replaced by Mr. Dibdin's ten-candle "pentane Argand," standardized from Mr. Harcourt's one-candle pentane air-gas unit, I directed my experiments to attempt to ascertain the effect of humidity upon these flames and upon the flame given by burning ordinary coal gas at the rate of 5 cubic feet per hour from the standard London Argand. My earlier experiments were made by surrounding the flames to be tested by cylinders to which the air supply had to pass through trays of drying or moistening material; but I soon found that, unless special precautions were taken, variations were caused in the rate at which the air was supplied to the flame, whilst with any cylinders obtainable the rise in temperature due to the heating effects of the larger flame were sufficient to entirely upset the results.

With a view of as far as possible eliminating these disturbing factors, an open bar photometer was fitted with the burners and disc 14 inches above the level of the table; and cylinders of thin glass, 12 inches in diameter and 24 inches high, were specially made by Messrs. Powell. The tubes carrying the burners rose straight from the photometer-table, and were provided with sliding collars with four arms, to support the glass cylinders. Flat perforated zinc boxes were made to fit in the cylinders exactly an inch in depth; and were surrounded with soft felt, so as to prevent any air passing up between the cylinder and box. These boxes, having been completely filled with wet or dry pumice or calcic chloride, as the case might be—the material having been previously sifted to pass through a three-eighth mesh, but not a one-eighth—will each give very nearly the same amount of obstruction to the passage of the air; whilst, to prevent the air entering the top of the cylinder, and to quickly remove the products of combustion, a zinc plate was fitted over each cylinder, with a 2-inch tube with a funnel-mouth descending to within a short distance of the top of the flame. With this apparatus a long series of observations were made, to ascertain if the idea that the small flame is more affected by moisture than the more powerful one was borne out by comparative experiments; and, in order to do this, both the one-candle unit and the large flame were surrounded with cylinders, and burnt under similar conditions—*i.e.*, in one set of readings each flame would have the air supply passing through dry pumice to give the normal results, whilst for dry and wet both flames would have discs of wet pumice or calcic chloride at the base of the cylinders. The results agreed with those obtained by Mr. Methven, and seem to prove that excessive moisture in the atmosphere supplied to the flames, by affecting the small flame more than the large, causes the gas to read high; whilst dry air, by allowing the small flame to do its best, causes a slight diminution in the recorded illuminating value.

The facts which appeared to throw most doubt on the power of a small addition to the atmospheric moisture making a large difference to the luminosity of a flame are as follows:—

(1) Mr. Vernon Harcourt made a long series of experiments, extending over several months, in which the one-candle pentane unit was tested against an electrical standard, in order to ascertain the effect of the height of the barometer upon the light emitted by the flame. During this long period, no variations were observed which led Mr. Harcourt to suspect that humidity had any influence on the amount of light emitted, although there must have been considerable changes in the quantity of moisture present.

(2) When the action of moisture on flame was first pointed out, Mr. Greville Williams, F.R.S., and Mr. W. C. Young each made independent experiments, by testing the gas against candles during one portion of the day with the air in its normal condition, and then watering the floor of the testing-room, and taking another series of tests. Neither of them was able to detect any difference in the value ascribed to the gas by the candles.

(3) It seems inconceivable that, with the large proportion of water vapour already present in the flame as a product of combustion, the small additional quantity present in the air should make so large a difference.

(4) In making the experiments described above, it was observed that the temperatures in the cylinders were uniformly higher when dry air was passing than with the experiments with wet or normal air; and these differences were far greater than could possibly be explained by any absorption of heat by water vapour.

With a 15 to 16 candle flame, the temperatures were: Normal, 91·60° Fahr.; wet, 86·1° Fahr.; dry, 105·69° Fahr. With the 10-candle flame, they were: Normal, 87° Fahr.; wet, 85·8° Fahr.; dry, 97·5° Fahr.

It was naturally felt that the increase in illuminating value of the dried air was probably due to this increase in the temperature of the air in which the flame was burning—the effect of temperature upon luminosity being well known. Mr. Harcourt suggested that the reason for the increase in temperature was that the calcic chloride became to some extent broken up; thus forming a closer layer, and retarding the flow of air. I could not conceive this being the cause, as all the material used in the discs being of the same size, and no shaking taking place which would be likely to break up the calcic chloride, it seemed most probable that, if any interference took place, it would be in the moistened pumice, as water would to a certain extent close the pores of the material. The fact of the difference in temperature, however, remained, and was quite sufficient to throw grave doubts upon the results.

In order to ascertain if there was any difference in the rate of passage of the air through the cylinder, a delicate anemometer was obtained; and its readings were corrected by a known flow of air. The tube carrying off the products of combustion was then elongated, so as to bring the temperature of the escaping gases down to a little over 100° C., and the anemometer fitted in the mouth of the tube; discs containing dry and wet pumice and calcic chloride respectively being employed at the bottom of the cylinders, as in the previous experiments. The standard pentane Argands were used as the sources of light—the value of the one burning in the open air being given in terms of the one in the cylinder—and the experiments showed precisely the same class of results as in the previous long series; and at the same time it was found that the flow of air was practically identical in each ease.

The next question that presents itself is, Does the difference in the temperature observed, from whatever cause arising, make the difference observed in the illuminating value? The only way to try this was to make the experimental chamber so large that the heating of the walls would not vary to any great extent, and the temperature therefore would remain fairly constant. In order to do this, a zinc chamber, 3ft. 6in. by 3ft. 6in. by 4ft., was constructed at one end of the photometer-bar, with a glass window of carefully flatted thin sheet-glass cemented in gas-tight on the side next the disc, and a door having a small window, and closing practically gas-tight on the opposite side. The burner was arranged at the centre of the chamber, so that half the chamber overlapped the bar; and a ventilating-tube 3 inches in diameter, with a funnel opening, came down through the roof to a few inches above the flame. Openings, closed with india-rubber corks, were arranged at the bottom and at intervals up the sides, in order to admit thermometers; and two false bottoms of perforated zinc were placed in the bottom of the chamber, to ensure an even distribution of the entering air. A ten-candle pentane Argand was fixed in the centre of the chamber; and was compared in the following experiments with a second one fixed at the other end of the bar. The burner in the chamber was allowed to burn coal gas all night, with the door and all the openings of the chamber open, so as to get an even temperature; and in the morning, the pentane Argand having been supplied with carburetted air, the door was closed and the bottom air-inlets left open, and a normal test was taken. Saturated cloths were then hung in the chamber; and, as soon as the wet and the dry bulb thermometers showed the air to have become highly charged with moisture, the wet readings were taken. These experiments conclusively proved that, in the former set as in these, the rate of flow and the temperatures in the cylinders have practically nothing to do with the effect of the moisture of the air upon the

luminosity of the flame; and that the variation in the temperature in the cylinders was in reality due to the variation in the temperature of the flame, caused by the cooling action of the water vapour upon it.

In order to prove, if possible, that this is the case, I made a small thermo-couple of platinum and platinum with 10 per cent. rhodium wire; using it as thin as possible, to reduce errors from loss of heat by conduction, and keeping the wires of considerable length, to prevent any chance of a rise of temperature introducing conflicting currents at the connections with the galvanometer wires. A reflecting galvanometer was employed; and sufficient resistance—50 ohms—introduced into the circuit to keep the spot of light upon the scale at the highest temperature of the flame. The scale was then graduated for temperature, by taking water at 0° C. and 100° C., and checking the higher temperatures by the fusing-points of the chlorides of the alkalies and alkaline earths, as determined by Dr. Carnelly. The thermo-couple was attached firmly to the base of the one-candle unit; and the junction was inserted at the tip of the non-luminous zone of the flame, so as to avoid the deposition of carbon, which would alter the temperature to a slight extent. The top of the inner cone is far from being the hottest part of the flame; but it will vary in temperature with the rest of the flame, although probably not to so great an extent. Working in this way, with the flame in a partly dry and saturated atmosphere, the following values were ascribed to a 10-candle standard, burning in the open air at the other end of the bar:—

Dry.		Wet.
9·9	..	10·6
9·9	..	10·6
10·0	..	10·6
10·0	..	10·6
9·7	..	10·6
10·0	..	10·5
10·0	..	10·4
10·3	..	10·5
10·0	..	10·6
10·0	..	10·8
9·99		10·58

Temperature of the flame at the top of the non-luminous zone	1022°C. ..	903°C.
Grains of moisture per cubic foot of air	4·9 ..	6·6
Degree of saturation	42 ..	88
Temperature in cylinder	82°F. ..	68°F.

This experiment makes the cause of the diminution in light of the pentane unit perfectly clear, as an increase of 1·7 grains of moisture makes a difference of 119° C. in the temperature of the flame, and a consequent loss in its power of emitting light. In order to satisfy myself that there was no error, the temperature of the pentane unit was taken at the same spot, when burning in normal air; and it gave as a result 932° C.—there being present 5·2 grains per cubic foot of air, and a degree of saturation equal to 65° C.

The next experiments made were to determine the alterations in temperature taking place in the ten-candle standard pentane Argand flame, with alterations in the humidity of the atmosphere. To do this, the thermo-couple was, as before, fixed to the burners, so that it could not move; and throughout the experiments the flame was kept at a constant height—the twist of the platinum and platium-rhodium wires being plunged into the flame just below the point at which it became luminous, so as to avoid deposition of carbon upon it. In order to prevent any possibility of change in position of the wire, the burner was fitted with the cylinder and a disc of dry pumice so as to first obtain the "normal" results. Water was then freely sprinkled on the disc, in order to saturate the air for the "wet" readings; and, after allowing this moisture to evaporate as far as it would, a layer of calcic chloride—coarse—an inch in depth was placed on the surface of the disc to dry the air. The anemometer readings show the result was not influenced by the rate of flow of air through the apparatus, which was practically identical in each case.

	Wet.		Normal.		Dry.
Temperature of flame	1367°C.	..	1395°C.	..	1449°C.
Anemometer reading	401	..	401	..	405
Temperature of products of combustion	100°C.	..	101°C.	..	105°C.
Dry bulb	67°F.	..	68°F.	..	83°F.
Wet bulb	65°F.	..	64°F.	..	69°F.
Degree of humidity	88	..	78	..	45
Grains of water per cub. foot	6·40	..	5·80	..	5·40
Percentage of water vapour	1·81	..	1·64	..	1·53

In this set of experiments, a difference of 82° C. has been produced in the temperature of the flame by an increase of 1 grain of moisture per cubic foot of air, or an increase of 43° in the degree of humidity; whilst with the 1-candle unit in the previous experiment, a difference of 1·7 grains in the amount of water vapour present gave a variation of 119° C. in the temperature, or 70° C. for each grain.

Mr. Methven, in his admirable paper, attributes the greater loss of light which the small flame undergoes in comparison with the larger flame to the superior power which the latter has of battling with the moisture; but I think the more probable explanation is to be found in the fact that a reduction in temperature between 1300° and 1400° C. makes far less difference to the light emitted by the incandescent matter in the flame, than the same difference taking place between 1000° and 900° C. From these experiments, I have no doubt but that the result is caused by the cooling of the flame, due to increase in the humidity of the air; but it has now to be decided whether it is alteration in the degree of humidity—*i.e.*, in the amount of saturation—or absolute quantity of aqueous vapour present which brings this about.

In the large number of tests which I have made, there have been some which could only be explained on the supposition that it was the degree of saturation which was the active agent, and not the amount of water vapour present. Such examples are of fairly frequent occurrence; and the two following sets of experiments, made with an ordinary coal-gas flame, burning at the rate of 5 cubic feet per hour, from a "London" Argand, under varying conditions against a 10-candle standard, show this:

Readings of Gas-Flame in Cylinder against Normal Ten-Candle Pentane Argand.

A		B		C
13·10	..	12·30	..	13·60
13·10	..	12·20	..	14·00
13·10	..	12·00	..	13·90
12·90	..	12·20	..	14·10
12·80	..	12·10	..	14·00
13·10	..	12·30	..	13·60
12·80	..	12·00	..	13·60
12·60	..	12·00	..	13·60
12·90	..	12·10	..	13·90
12·80	..	12·10	..	13·70
12·92	..	12·13	..	13·80

Rate of flow of gas	5 c. f.	.. 5 c. f.	.. 5 c. f.
Temperature in cylinder—wet bulb	63°F.	.. 64°F.	.. 68°F.
" " dry bulb	70°F.	.. 64°F.	.. 81°F.
Grains of moisture per cubic foot	5·2	.. 6·6	.. 5·4
Degree of saturation	65	.. 100	.. 47

Here there is an increase of 0·8 candle in the light emitted by the flame in Cylinder C over A, though there is 0·2 grain of moisture per cubic foot of air more in C than in A; but the degree of saturation is 18° less in C than in A.

Another experiment of the same kind gave—

A		B		C
12·30	..	11·40	..	12·70
12·30	..	11·40	..	12·80
12·10	..	11·10	..	12·50
11·90	..	11·10	..	12·80
11·80	..	11·10	..	12·70
12·40	..	11·00	..	12·60
12·00	..	11·10	..	12·60
11·90	..	11·10	..	12·60
11·70	..	10·80	..	12·70
11·90	..	11·20	..	12·90
12·03	..	11·13	..	12·69

Rate of flow of gas	5 c. f.	.. 5 c. f.	.. 5 c. f.
Temperature in cylinder—wet bulb	58°F.	.. 61°F.	.. 63°F.
" " dry bulb	66°F.	.. 63°F.	.. 75°F.
Grains of moisture per cubic foot	4·2	.. 5·6	.. 4·6
Degree of saturation	60	.. 88	.. 49

These tests, I think, show conclusively that it is the degree of saturation of the atmosphere, and not the actual amount of water vapour per cubic foot of air, which acts in this powerful manner upon the temperature, and therefore upon the light that is emitted by the flame. When the degree of saturation is low, the large amount of water vapour produced by the flame itself rapidly diffuses, and is taken up by the air; and hence the withdrawal from the flame is more rapid than when the air is nearly saturated. And in the latter case, the large quantity of water vapour remaining longer in the flame, cools it partly by physical and partly by chemical action. On analyzing the gases at the extreme edge of the flame, the water vapour is found to vary from 14 to 15 per cent. by volume near the base, where the hydrogen and methane of the gas have rapidly diffused to the exterior—and are, therefore, the principal gases entering into combustion—to 11 per cent. near the top of the flame. The water vapour in the atmosphere is, on the average, 1·5 per cent. by volume; and at temperatures below 70° Fahr., it rarely, if ever, exceeds 2 per cent.

At the high temperatures existing in the cylinders during the experiments on the effect of humidity upon the light emitted by the ten-candle pentane Argand, the variation was from about 1·8 per cent. by volume in the dry cylinder to 2·4 per cent. in the wet; and it seems absurd to suppose that a difference of 0·6 per cent. by volume, or 2·3 grains by weight, should make the large difference observed in the illuminating value of the flame. If, however, it is the degree of saturation which is the active factor, we at once find the explanation of the effect, as the degree of saturation in the dry cylinder averages 33°; whilst in the wet, it rises to 66°—a difference of 33 per cent. The effect being due to the degree of saturation also explains the fact that the action of humidity has not been before observed during the daily testing of the illuminating power of the gas; as, although the variation in the amount of moisture present in the atmosphere is very great between winter and summer, yet the degree of saturation does not vary to anything like the same extent. Moreover, the moisture present in the outside air in no wise represents the moisture present in testing-stations kept at carefully regulated temperatures. I think it would be found that, if the temperature could be kept within a narrow range—say, between 60° and 66° Fahr.—the trouble would practically disappear, except under the most abnormal conditions.

I have kept a record of the degree of saturation of the atmosphere in my testing-room at Guildhall Chambers during the two autumn and two winter months; and find that the degree or percentage of humidity only varies within a narrow range. The average for August and September was 74·5, whilst for November and December it was 75·1; and nearly the whole of the determinations fall between 70 and 85°. The testing-room at Guildhall Chambers has no ventilation or proper means of keeping a constant temperature; and I should expect, in a station having these advantages, the readings would be still more constant. Accepting the variation of from 70° to 85° of humidity as the average range in a testing-station, it is interesting to see how this would affect the light emitted by the various burners; and, in order to satisfactorily settle this point, the following experiments were made, by testing the one-candle flame and the ten-candle pentane Argand separately against as nearly as possible constant standards, whilst the two flames being tested are subjected to known variation in humidity. On doing this, the following results were obtained as the mean of a large number of observations:—

One-Candle Unit.	Normal.	Wet.	Dry.
Percentage of saturation . . .	75·60 ..	93·50 ..	45·70
Grains of moisture per cubic foot .	5·53 ..	6·30 ..	4·06
Illuminating power in candles. .	0·932 ..	0·874 ..	1·0332
Ten-Candle Unit.			
Percentage of saturation . . .	66·50 ..	76·00 ..	37·00
Grains of moisture per cubic foot.	7·10 ..	7·60 ..	5·60
Illuminating power in candles .	9·81 ..	9·53 ..	10·30

And it is evident from this that the maximum variation of 15 per cent. in the humidity of the air of a testing-station would only cause a variation of about 2 per cent. in the value ascribed to the larger flame by the one-candle unit.

The question has been raised as to whether, in view of the action of humidity upon flames of different size and character, it would not be better to test the illuminating value of gas against a standard more nearly approaching the value of the flame to be tested than by the ten-candle pentane Argand. To decide this point, I have made a long series of observations, in which the value of a coal-gas flame, burning at the rate of 5 cubic feet an hour in a standard London Argand, under normal wet and dry conditions of the atmosphere, is expressed in terms of a ten-candle pentane Argand burning under normal conditions.

The following are the mean of 330 observations:—

	Normal.	Wet.	Dry.
Illuminating value of the flame in candles .	16·98	16·18	17·30
Percentage of saturation of the air . . .	56·00	87·60	46·80
Grains of water per cubic foot of air . . .	6·18	7·08	6·06

Showing a variation of 7 per cent. in the illuminating value of the flame for a difference of 40·8° in the percentage of saturation, or 1·7 per cent. for 10°.

It is now possible to tabulate the effect of the percentage of humidity upon the various flames as follows:—

An increase of 10° in the percentage of saturation of the air causes a diminution of—

3·3 per cent. in the light of the One-candle unit.
2·0 " " Ten-candle Argand.
1·7 " " 16 to 17 candle flame.

This means that the extreme variation of 15° likely to occur in the humidity of the atmosphere in a testing-station, might cause a variation of 0·45 per cent. in the light credited to the gas-flame by the ten-candle pentane Argand, which would amount to 0·07 of a candle.

Important as these considerations are in relation to gas testing, it is manifest that moisture present is not likely to cause any serious loss in the illuminating value of gas as burnt in a room, as in the heated zone in which the gas is burning, the degree of saturation will be considerably below that existing in the original air, although the absolute amount of water vapour present will be higher. At the same time, however, another factor begins to come into play, which does exert a serious influence upon the flame; and that is the carbon dioxide produced as a product of combustion, and the consequent diminution to a minute degree of the oxygen present in the atmosphere.

Taking the flat-flame gas-burners of the domestic sizes—*i.e.*, Nos. 4 and 5—it will be found that, when the carbon dioxide has risen, as it generally does rise, in the upper zone of the room to 0·4 per cent., the illuminating value of the flame will have been diminished by nearly 12 per cent.; and the effect upon the Argand seems to be nearly as great. These results show us that, important as good ventilation is for the health of the human being, it is equally important to the illuminant itself; and that we must look upon all improvements in ventilating burners as important steps, not only in popularizing the use of coal gas, but also as improvements in the amount of light to be obtained from gas. In making such improvements, I would strongly urge upon the gas engineer the importance of discarding metal pipes for carrying off his products of combustion; as, although the sulphur present in the coal gas makes practically no difference to the health and furniture in a room, whether it contains 20 or 30 grains per 100 cubic feet, yet as soon as the products come to be cooled down in the tube which is leading them away, the condensation of water vapour at once means the production of small quantities of sulphuric acid, which rapidly attacks metal tubes, and by eating them away becomes an active source of danger where such tubes are led for any considerable distance through the floor spaces.

In concluding this lecture, I venture to hope that I have been able to awaken some fresh thoughts in your minds upon a somewhat hackneyed subject, and also to give experimental data which, in practical hands, may be made to bear fruit.

PAPERS READ AT THE MEETING.

ON GAS-FITTINGS AND THEIR SUPPLY BY GAS UNDERTAKINGS.

By JOHN LYNE, of Wexford.

In the ordinary routine of daily life, it must often be experienced that, of all things, the hardest to bear with patiently are blame and reproach which are undeserved. The manufacturers and vendors of almost all necessaries of modern life have, in the practice of their callings, a hard task to escape the unfair criticism and censure of the customer, and the consequent depreciation of their productions and commodities in the eyes of the public. But they have, as a set-off to this, the advantage of learning the precise requirements of the purchaser, and can rely on the fact that the ordinary commercial laws of demand and supply tend surely, if slowly, to bring about an equilibrium between the ideal of perfection demanded and the article actually supplied.

In this respect, there is no large and efficient body of public providers so heavily handicapped as those actively engaged in the manufacture and distribution of gas. Their chief saleable product has, in the public mind, a considerable amount of mystery about it—differing so much in its nature from all other wants; and it is so readily turned into a source of danger and waste when controlled by careless hands, and so easily ill-treated and robbed of much of its value through the medium of bad appliances, that it is indeed small wonder if the chronic opinion of many a consumer is unjust to the gas undertaking. Here it would seem as if the fixed theory of demand and supply proved to be a fallacy. Yet how well known is it, to persons who are competent to judge, that, in the great majority of instances, the quality of the gas supplied is not only fully up to the required standard, but frequently beyond it. It may, however, be allowed that, in spite of the gas

undertaking's earnest desire to satisfy the wants of the consumer, both as to quality and quantity, it often happens that he has just grounds for complaint, inasmuch as he is naturally unable to discriminate between deficiency of quality and insufficiency of supply; and whenever the quantity falls short, and shows a bad result at the burner, he must, in ignorance, condemn the quality. The consumer's demand is really one for better light; and it will be admitted that, in ninety-nine cases out of a hundred, some partial remedy at least lies in improved distribution.

It would not be wise, in such an assembly as this, to raise the possibly contentious point as to whether those who control the internal or external departments of a gas-works are more often at fault. But those who, like the writer, have to act in the dual capacity, may be assumed to be practically impartial in the matter, and will no doubt, as a general rule, allow that when there is any genuine need for improvement, it is in the matter of proper distribution. This the writer takes in the broad sense to include complete distribution through all internal fittings and appliances whatsoever, as well as through mains and services. A natural sub-division of this line of distribution, would be at the point where the internal and external service may be imagined to meet; and at this point begin many of the most serious obstacles to the general success of a gas undertaking—here at the very point where many managers unwisely consider that all their troubles have practically ceased, and beyond which they have at most to secure the needful registering of every cubic foot that passes through the meter.

The progress of gas from the retort onwards through all the stages of production, receives all the care, skill, and attention that untiring industry and shrewd common-sense can bestow on it. Able men—some passed away, some living—many of whom have made their mark outside their own profession, have brought to bear on it that inventive genius and practical ability which help so much to make gas still out-distance all its competitors, both the old and the new. It is evident that, to keep it in this proud position for the future, those combined efforts of head, heart, and hand must not be relaxed; and it is with a view of focussing more general attention upon what he considers one of the weakest spots in an otherwise robust constitution, that the writer has ventured this paper.

A bad system of internal house-fitting is the arch-enemy of every gas undertaking. It discourages consumption; it is a heavy and needless addition to the consumer's expenses; and it keeps customers at war with the gas undertaking, ever promoting strife where the most friendly good feeling is for many obvious reasons absolutely necessary. This matter of internal house-fitting, though a simple subject, is in the writer's opinion deserving of the earnest attention of the members of this Institute; and in putting his views before this meeting, he aims not so much at giving information on things pretty well known, as at eliciting it for the common benefit. He further desires that a decisive note be here sounded on the necessity there is for manufacturers of gas-fittings bestowing much more care on details of the articles they make than has usually been done hitherto, so that those who wish for such may have no difficulty in obtaining durable well-finished appliances. The writer treats all as fittings, from the point where the service-pipe terminates within the house to the burner-tip, including even the meter, as it is an indispensable adjunct, and, apart from its duty as a measure, not without its effect on all. He feels somewhat reluctant to go at all into details on what may be considered trivial matters well known to every member; but he thinks a brief review of essential appliances is necessary.

The main-tap, whether charged for or not, is usually supplied by the gas undertaking, and is too frequently an unreliable and short-lived article. To maintain unchanged the shape of the current, it should have a circular gas-way, which ought, except perhaps when used for the smaller class of houses, to be of the same diameter as the service-pipe. Unlike most other articles produced by makers of gas-fittings, the writer is glad he can say it is possible to obtain a reliable and durable article of this kind in gun-metal—the most suitable material in his opinion—practically as perfect as could be desired, and at a moderate price.

Passing on to the meter, there are two kinds to choose from—the wet and the dry. The writer knows how reliable the former is, from a gas manager's point of view, looking at it merely as a measure, provided the level of the liquid with which it is charged could be properly maintained. He boldly asserts, nevertheless, that a wet meter is a thing not to be tolerated in any house of even moderate size; and it should only be used, if at all, for small consumers. The chief objections to it are well known, such as sudden extinction of lights without any warning, and oscillation caused by evaporated water getting deposited in the pipes—both sources of much annoyance to the gas consumer, and to those connected with the supplying of gas. The writer considers it much better on the whole to run the risk of losing say a little gas, which may occur occasionally, through the use of dry meters. Any possible loss in this way will be more than compensated for by the satisfaction given to consumers, by a saving in the cost of inspection, and a considerable saving in first cost and maintenance. He therefore strongly advocates the use of the dry meter.

For indoor purposes—such as for dwelling-houses, shops, and public buildings—the writer considers that what is known as composition pipe should alone be used, as it is durable, not liable to corrosion externally or internally, and recommends itself for the rapidity and ease with which it can be laid, and the readiness with which it can be extended, altered, or removed. Once done well, it may practically be considered everlasting. In laying such pipe, all jointing should be done with the blow-pipe; and no union or brass connection of any kind should be used between the outlet of the meter and the brass-screwed ends to which the brackets or pendants are attached. Wherever possible, the rising pipes should be sunk into the walls, and the horizontal pipes laid under flooring boards, and as far as possible parallel to their length. The boards over such pipes should be fastened down with screws. There are places—such as railway platforms, workshops, and stores—for which iron pipe will suit best, as being less liable to external injury and easy to suspend or to sustain. The diameters of pipes, as usually advocated for any given maximum consumption and for any given length of supply pipe, are, in the writer's opinion, rather smaller than they should be. More satisfactory results can be obtained with a low pressure than many persons seem to be aware of, if there is an abundant supply up to the very point of consumption, such as a large pipe will give; and in laying down internal services, this combination of large diameters with possible low pressures is one that should not be lost sight of. In recommending the above kind of piping for indoor purposes, the writer is aware that it is not new, and that it has been in use for a long time in many places. He considers it good; but if some members know a better system, he trusts they will take an opportunity of giving the meeting the benefit of their experiences.

It may be asked, what does the gas consumer think of the plan of laying large pipes, and of enlarging pipes laid at some former time but now too small. The writer feels much pleasure in being able to speak most highly of his best friend the gas consumer; and his experience is that consumers are willing to have large pipes laid or smaller pipes enlarged, when sufficient care is taken to show them that, from increased consumption or other justifiable cause, it is necessary to do so. And, further, that the consumer always appreciates fair treatment and a desire to meet his wishes and wants; that he will even pay what he considers an excessive gas bill, with very little grumbling, if only convinced that all that was possible to do had been done to ascertain that there was no error.

Before making a few remarks on domestic fittings and appliances, the writer feels that it is right to refer to the striking contrast which exists between the excellence of all ordinary plant required in the various stages of production or initial distribution of gas, and the too general inferiority of internal domestic apparatus used for its consumption. In each case the demand is, of course, primarily responsible for the supply. The gas engineer looks chiefly for a high degree of perfection; and his wants are carefully studied and thoroughly met by the makers of gas plant, to whom the greatest credit is consequently due. The ruling factor, however, which governs the supply of all kinds of internal fittings, seems to be a demand for cheapness.

One would be inclined to say that almost anything is considered good enough for gas-fittings; and the real reason for this appears to be due to the fact that such articles

are chiefly made for what is known as "the trade," many persons engaged in which do not, and cannot be expected to take such an interest in securing as serviceable articles for their customers as a gas undertaking would, or should, if they had the supplying of them. With "the trade" the selling and fixing, as well as the repairs of fittings, is done for profit alone; while for a gas undertaking this profit would be a mere secondary consideration, the consumption of gas to the best advantage being the end to be attained.

It would be rather too much, in a paper of this kind, to go into all the defects of fittings. It will suffice to enumerate some of them—such as taps and swivels too light, so poorly fitted that very little service causes them to leak; gas-ways frequently so small that they will not much more than admit that well-known domestic implement, a stocking needle; stops for cocks, so carelessly put in that an inadvertent attempt to turn a tap in the wrong direction suffices to destroy it; pipes often so light and so poorly brazed that they easily crack across or split from end to end; inner tubes of water-slide pendants to supply three or five lights, seldom more than $\frac{1}{4}$ inch internal diameter; pipes attached to ball-joints never more than $\frac{1}{2}$ inch diameter outside for five-light, and less for three-light pendants; the ball-joints themselves too weak where they should be strong, so that they are hardly able to sustain the weight of the pendant; and balance-weight chains of an exceedingly weak description. The writer considers that the use of the water-slide, and of all other sliding pendants, should be strongly discouraged; as also should the use of brackets with more than one swivel, and of india-rubber or other flexible tubes—especially for connecting cooking or heating stoves, except for very temporary purposes. For evident reasons, no easily-fused pipe should be nearer than (say) 2 feet to gas-jets supplying stoves with atmospheric burners. Designs of fittings are too often poor, with ornament in the wrong place, and weight of brass where it is worse than useless.

Having attempted to point out some of the too palpable defects of internal gas-fitting, it will now be expected of the writer to propose or advocate some practical remedy. This is, of course, suggested by the heading of the paper; and as far as the writer can see, it is the only remedy available. Gas suppliers cannot afford to ignore the fact that they have to act as the vendors of their own product; and that serious and continuous loss must result from the policy of keeping aloof from the customer. The mere fact of a gas-works being the only one in a district, is no guarantee that it will enjoy a monopoly of artificial lighting. To arrive at the maximum of success, the relations of producer and consumer should be closer. If every gas undertaking would supply and put up fittings, or even make an earnest beginning in this direction, not necessarily attempting to do all the work of their districts from the outset, a very much needed improvement in all domestic gas appliances would soon be effected. A demand would arise for a better class of fittings all round, to the benefit of the manufacturer, of the consumer, and of the gas undertaking. What a great advantage it would be to the gas consumer to have in his city or town a show-room for all kinds of domestic gas appliances; where he would be certain of being received with a *cead mile failte*, and be sure of getting sound advice, needful instruction, and such things as he may require, at moderate prices. Care should, of course, be taken in selecting the stock for such a place; but even with caution in this respect, articles might occasionally find their way into stock which, if they could not be returned to the makers, should rather be broken up for the melting-pot than sold to a gas consumer. Even in the selection of burners, globes, and accessories great services can be rendered to customers; and how surely will such services have their good effect eventually on the success of the gas undertaking!

A few words may be introduced here on burners, globes, globe-holders, &c. The flat-flame gas-burner is still the one which is used most frequently; and though a decided improvement was introduced about thirty or more years ago, in making the tips of such burners of adamas, steatite, and similar materials, instead of iron or brass, and in making the slits smoother, there has been no very great advance since, except in substituting a flat-flame or slit union for globes, instead of the union-jet. In the Argand burner, and the shades and appliances to be used with it, there has been a very decided step in advance. Not only have high results in the illuminating power been obtained from the gas consumed, but the designs of globes, shades, and holders are artistic, beautifully finished, and highly creditable to those who introduced them. The ordinary globe, with large under opening, was also a most successful innovation; and though globes of this shape are now used almost universally, the manufacturers of fittings still persist in sending out the holders for the old-shaped globes with narrow openings.

The regenerative burner, in respect of increased illuminating power, is, of course, a vast improvement on all that preceded it; but the writer regrets to say that, in his opinion, the average consumer does not care to take the trouble of managing it. No doubt, where specially powerful lights are needed, some will take the necessary pains. He hopes it may be possible to simplify it and produce it at a lower price. A newer burner—the incandescent—is also somewhat troublesome; and, in the writer's opinion, the light is not so free from fluctuation as it might be. If the simple flat-flame burner could be improved, so as to give a much higher illuminating power, it would be of great advantage all round. All new burners, regenerative or otherwise, and combinations and adaptations of old ones, should be practically tested in actual nightly use for a sufficient time before being recommended to customers. As to ventilating burners, there is no difficulty in lighting and ventilating by means of gas large rooms and places of public resort; but the ventilating burner which can be easily, cheaply, and efficiently applied to the lighting and ventilating of private houses, with rooms of medium size, though it may be coming, has not yet come, as far as the writer is aware.

The writer will say now what perhaps he should have said at the outset, that he does not stand before you as a preacher who takes one course himself and exhorts you to take another. For more than a quarter of a century he has been connected with a gas undertaking that supplies and erects all fittings, and keeps a stock of all appliances required. In the first years, he found it rather annoying and distracting, as he had no previous experience in the matter; and he frequently thought of recommending his Directors to discontinue the practice, which they would have done had he so advised. He has cause to be glad that he did not take such a step, as he discovered years ago what a very great advantage it was to have not only full control of the sizes of pipes, but a voice in selecting all the appliances, including globes and burners. During all that time, it has been the practice to supply consumers with good burners free of charge, suitable for their requirements, or the districts in which they live.

One of the advantages of this control of pipes, fittings, and burners—and no small one—is that gas can be sent out from the works at a lower initial pressure than would otherwise be possible. It is all very well to lay down rules as to sizes of pipes, which may be successfully carried out; but of what avail if the good effects which should follow are counteracted by bad fittings and worse burners? It seems to the writer that a demand for proper appliances can only be created, encouraged, and maintained, through the medium of the gas undertakings; and thus having practically control of the demand, it will be their fault alone if the supply is not equal to it, and if the resulting advantages are not mutual.

Even the largest gas undertakings have considered it sound policy to supply cooking and heating apparatus to their customers; and they are constantly advising them as to the most suitable kinds, and taking pains to give instructions as to how they can be used to best advantage. The pipes are laid, and the stoves fixed in position almost invariably by their own competent and careful men. As gas used for cooking and heating purposes bears only a small proportion to that used for lighting, so much the more are the appliances for consuming the latter worth all the care and attention that can be bestowed on them.

GAS-BURNERS—A SUGGESTION.

By Thomas Travers, of Cork.

Much has been said and written on the value of good burners, as compared with bad, in developing the illuminating power of gas. Yet the majority of gas consumers appear to be indifferent to the importance of the point, notwithstanding that it was for their advantage that so much attention has been given to the matter by gas

engineers. This indifference on the part of consumers, I attribute to the fact of their being in most cases improperly advised; and there are not wanting instances where they have allowed prejudice to interfere.

When an intended gas consumer requires his house fitted, the gas-fitter will assist him in the selection of suitable gasaliers and brackets, as the case may be; and he will supply nicely decorated globes. But when it comes to the question of burners (as I stated in a former paper), I have never known a gas-fitter who took any steps to ascertain the quality and the pressure of the gas. As a rule, they appear to be ignorant of the fact that, in order to obtain the best results from burners, it is essentially necessary that they should be adapted both to quality and to pressure. Want of attention in this respect is the reason why we so often find that consumers are supplied with burners in what might be called a hap-hazard way, with results with which you are too familiar. I found ignorance of what constitutes a suitable burner to prevail in so-called high quarters, as the following will illustrate.

In a certain Government Department, complaints were made, in language such as Government officials know how to use when they believe themselves the happy possessors of a grievance. This time "Bad Gas" was the war cry. So loud was their complaint that little short of being allowed to increase the quality of the gas by carbonizing every member of the company (chairman and directors included) would form an acceptable sacrifice to the wrath of those offended deities. As usual, the gas manager was made the scapegoat; and he had to face the storm. A very brief examination was sufficient to reveal the true state of the case. Burners which were fixed about twenty years ago were up to this time doing duty; and the flame from them was such that the forked light of the early days of gas lighting would have been a vast improvement on it. The manager pointed out to the official who accompanied him that defective burners were the cause of the bad light; and he offered to prove this by removing the old burners and fixing new ones instead—which (like Aladdin's lamp) would be supplied free of cost. The offer was not only refused, but the manager was court-martialled, so to say; for, two or three days afterwards, he had to appear before a colonel and some other officers, and give his reasons for saying that burners which had been fixed in the department so many years ago by the War Office were unsuitable. He was allowed to put his reasons (in military parlance, "his defence") in writing. In his memorandum, the manager showed that the burners even when new, owing to their construction, did not give within 30 per cent. of the light obtainable from more improved burners; but that now that they were old there was not 20 per cent. of the available light from them. The document had to go to head-quarters; and after many days a communication was received that "honourably acquitted" him, and permission was given to exchange old burners for new. But one condition was laid down—namely, that the old burners should be carefully stored, in case a new Secretary of War might order them to be refixed.

We have also to contend with prejudice, which I have proved elsewhere to be groundless. But it's an old saying that prejudices die hard, and we have often evidence of this fact. When, as in the above case, the burners are unsuitable and bad, yielding an inferior light, the gas manager suggests that a change in the burners would improve the light without increasing the consumption; and he accompanies the suggestion with an offer to supply the burners. The offer is declined, for the reason that it is believed that it was only made for the purpose of increasing the gas consumption far and away out of proportion to any improvement that there may be in light.

With the undisputed fact before us that, in every average town, the waste occasioned by bad burners may be represented by a large amount of money every year, it is important to consumers that they should be supplied with the best appliances for the combustion of the gas, so as to minimize this waste. In justice to gas companies, I will say that they are more anxious to see this state of things improved, than consumers will give them credit for. The gas company's services would not be acceptable to many in altering the condition of affairs; and the gas-fitter, so long as he sells his other goods, will not trouble himself much about such a small item as a burner, and yet it is often the fulcrum of the lever in gas lighting. How then is the consumer to be served so as to obtain the desired results? My suggestion is that a public officer should be available to test, when required, burners for consumers. There are daily placed in the hands of such officials, with good results, matters which are of minor importance when compared with the large interests at stake in the gas industry. It may be said there are already in the several districts public officers to test the quality of the gas and the correctness of meters. What more is necessary? My answer is, "Even with the meter correct, and the gas of standard quality and often above it, the consumer at the point of combustion frequently does not get between 20 and 80 per cent. of the value of the gas; and thus he probably suffers a far greater loss than if his meter was not quite correct, or the gas not up to standard. In fact, until control is extended in the way suggested, the other advantages that may be said to be gained by such services are in many instances neutralized. Place the consumer in the same position in reference to his burners as he is now with respect to his meter. For a small fee, he can at any time ascertain the correctness of the latter. Let a small fee—say, per dozen burners—be fixed, on the payment of which the consumer can obtain the necessary information as to their suitability, &c.; and the meter-tester or other official should be in the position to afford the fullest information on this point.

High-class burners, such as of the regenerative type—which are made with much care and accurately tested—are not of the class to which I refer; my remarks are intended for ordinary burners in general use, and which occasion so much waste of light-giving material. The fact that a public officer would be available for the testing of such burners would have the effect of making manufacturers enter into rivalry, and of stimulating them to greater skill in their production. Thus an all-round good would be done. The burner makers would be sure to obtain their reward when excellence is attained; gas consumers would derive the largest benefit; and gas companies would also be sharers. Last, and by no means least, the much-maligned and misrepresented gas manager would have the brilliancy of his production reflected on his character, revealing it to be always irreproachable.

THE ENRICHMENT OF COAL GAS.

By Professor Vivian B. Lewes.

The question of enrichment is at the present moment of such importance in the minds of the gas managers of the country, that no apology is needed for bringing forward a paper which may be expected to give rise to ample discussion, even if it serves no more useful purpose.

Within the past year, two new processes have been experimentally perfected, which may be expected, from the results obtained, to have a not unimportant bearing upon this question; and as I have had the opportunity of thoroughly investigating them, I think my results and conclusions may be of interest. Mr. William Young, of Peebles, has brought the knowledge which he obtained in the distillation of shale oils to bear upon their further conversion into illuminating gas; and, in conjunction with Mr. Bell, he has erected and worked at the Peebles Gas-Works, an apparatus which, from its simplicity and the high results obtained, has attracted a large amount of attention, whilst installations on a far larger scale are already commencing work, and will shortly place the future of the process beyond doubt. The main idea underlying this process is to retort the oil at a temperature of about 900° to 950° C.; and, instead of condensing the vapours (which escape being broken up into permanent gases) in the usual way, to wash them out from the gas by means of the oil which is afterwards to undergo decomposition in the retort. By doing this, nothing but permanent gases leave the apparatus; the surplus carbon present in the oil being left as a deposit of dense coke in the retort. There is no doubt but that very considerable quantities of the olefines and other fixed gases are also absorbed by the oil; but as these are again driven out by the action of heat during the retorting, but little loss takes place. The installation at Peebles consists of two cast-iron retorts, about 10 feet in length, set so as to incline downwards to the far end. They are fitted with doors and ascension-pipes in the usual way; but in each door there is a small pet-cock, by opening which the colour of the gas can be seen. This should be of the palest lemon; as it is found

that, if any darker colour or approach to brown is produced, deposition of tar and other troubles commence. The oil to be cracked is admitted through small cocks about 2 feet up the ascension-pipe; and it falls down through the ascending gas on to steel plates, which extend 3 feet into the retort in order, as far as possible, to prevent the direct impact of the oil with the iron retort. This, however, has been found to be unnecessary, and has been omitted in the latest installation. The retorts are heated to about 900° C.

As the gas leaves the retort, it passes up the ascension-pipes which lead above the bed of retorts to the hydraulic main (situated at the back of the bench), and through a coil of horizontal condensing pipes, to the scrubber, which is of the well-known Young pattern, and made in four compartments. The oil-cistern is situated on the top of the scrubber; and the supply-pipe from it is so arranged that the oil can be made to flow into any one or all of the sections. Having passed through the scrubber, the oil flows back along the bottom of the horizontal condensers, in an opposite direction to that in which the gas is passing, and into the hydraulic main. From the hydraulic main, it passes through a seal into a small cistern containing a float, which is in connection with an indicator close by the oil-feed taps in the front of the working bench; so that, if the oil is either flowing faster than it is being decomposed or is not flowing sufficiently fast, the supply of oil from the cistern can be regulated so as to keep the balance constant.

The oil used is what is technically known as "blue oil," and has the specific gravity on an average of about ·850. Each retort will make 500 cubic feet of gas per hour; and 5½ cwt. of a very dense form of graphitic coke is deposited in the retort for each ton of oil decomposed. This coke collects almost entirely near the back of the retort; and, shrinking from it, it can be readily removed. The coke forms with a practically horizontal surface, which suggests that it has either flowed to the back of the retort in the condition of pitch, and has been carbonized there, or else that the oil has washed it back from the front of the retort and ascension-pipes. The cost of the plant is low; and the installation which is fitted at Galashiels—and which is considered sufficiently large to make 120,000 cubic feet of gas per day, though 60,000 cubic feet only will probably be wanted—has cost a little over £1000. The working for several months at Peebles gives an average of 85 cubic feet of gas per gallon of oil; and, although when this gas is tested on an open-bar photometer with a "No. 000" flat-flame burner, it only tests up to from 50 to 60 candle power, yet when used to enrich 18-candle gas made at Peebles from splint coal, it works out on the enrichment figures to 90-candle power, and sometimes more. This discrepancy is due to the fact that the smallest burners are required to burn so rich a gas without smoking; and as soon as the flame falls below a certain size, the cooling power of the burner exercises so great an influence on the light emitted by the flame, that it is impossible to develop the true illuminating value of the gas. Taking the enrichment figures as the true value of the gas, we have 85 feet of 90-candle gas, or 1530 candles per gallon of oil.

These figures are so remarkable that it will be of interest to give a brief summary of the results of the analyses which I have made of the products; and by their aid to trace the various actions taking place during the decomposition of the oil. On analyzing the gas, it was found to consist of—

Hydrogen	16·85
Unsaturated hydrocarbons	44·83
Ethane	17·30
Methane	19·00
Carbon monoxide	0·00
Carbon dioxide	0·63
Oxygen	0·24
Nitrogen	1·15
	100·00

together with a distinct trace of sulphuretted hydrogen derived from the sulphur in the shale oil. On withdrawing samples of the oil circulating in the apparatus, it was found to be highly charged with naphthalene, and to contain only small traces of hydrocarbons with low boiling points; but the oil from the trays in the scrubber consisted of the original oil highly charged with benzene and light saturated and unsaturated hydrocarbons boiling between 65° and 140° C.—chiefly hexane, heptane, nonane, hexylene, and heptylene.

These data point to the fact that in the retort the shale oil decomposes in the usual way, yielding saturated and unsaturated hydrocarbons—some gaseous, and some vapours of volatile liquids. The contact with the hot sides of the retort causes the splitting up of some of the ethylene into ethane, methane, and acetylene; and the latter at once polymerizes into benzene, and still further into naphthalene. Leaving the retort and passing through the condensing coil, the oil dissolves out all the naphthalene from the gas; whilst in the trays of the scrubber, the close contact with fresh oil removes the vapours of benzene and anything else which could afterwards undergo condensation. It is this which makes the Young gas so permanent. The coke which remains in the retort gives on analysis—

Carbon	98·62
Hydrogen	0·35
Sulphur	0·38
Oxygen, &c.) Nitrogen)	0·46
Ash	0·19
	100·00

The extreme density, hardness, and low sulphur will make this coke of value for metallurgical work.

In approaching the question of cost of enrichment with such a gas, we must remember that it is entirely dependent upon the locality of the works, which will to a great extent govern the cost of the oil. The blue shale oil which is at present being used at Peebles can be obtained there at about 2d. a gallon; and the supply will probably be sufficient for the comparatively small installations now being erected. But should the process come into anything approaching general use, it will be impossible to obtain any very great quantity of shale oil at this price. It will then be necessary to revert to Russian oil; and it will not be safe to reckon on a large supply at less than 3½d. per gallon, except in a few favoured localities where it can be shipped alongside. Taking the yield of gas at 85 cubic feet of gas per gallon, it will require roughly 11¾ gallons to yield 1000 cubic feet; and this amount of oil can be decomposed in one retort in two hours. The fuel used, however, is not very large, as a good deal of the heat from the ordinary benches can be utilized. A fair calculation of the actual cost would be 4s. 2d. per 1000 cubic feet.

The second process which I wish to bring to your notice is one for which I am responsible, and which is the result of attempts I have made to get over some of the drawbacks to be found in the ordinary carburetted water-gas processes. Through the kindness of Mr. A. F. Wilson, I have had the opportunity of using some spare plant at the gas-works at Aldershot; and after nearly two years' experimenting, I think, have succeeded in making a carburetted gas which in composition and properties will more nearly approach a rich coal gas than any which has been proposed. Mr. Young's admirable process is one for enrichment pure and simple; but there are many works where space is an important factor, and where it would be difficult to provide room for a bench of oil-gas retorts, whilst many managers would be glad to increase their power of daily production, and also have an ally which would enable them to produce gas with great rapidity in case of fog or labour troubles. It is to this latter class that the carburetted water-gas plant, and my modification of it, will appeal as an enrichment process.

I need not here describe the various water-gas processes which have attempted to gain a foothold in England. It will be sufficient to say that the only one which has been commercially successful is the "Improved Lowe," by means of which several million cubic feet of gas are daily made at Beckton, and supplied mixed with coal gas to the London consumers. The only objection I have to raise to this process is that the purified gas contains about 30 per cent. of the highly poisonous carbon monoxide, and also that the method of decomposing the oil which is used, does not yield as high a result as can be otherwise obtained. The result of the Beckton working gives the cost of 25-candle gas as (roughly) 2s. per 1000 feet.

In attempting to improve upon this process, I have aimed at reducing the quantity of carbon monoxide in the gas, and increasing the hydrogen—at the same time retaining the rapidity of make which gives carburetted water gas so great a charm, and also doing away with the large external superheaters which are so expensive and

troublesome an item in the Lowe apparatus. In order to do this, I constructed a vessel of ¼-inch plates,* lined with fire-brick, and divided internally into three compartments; the two end ones being filled with small pigs of iron, and the centre chamber with fuel. Coke in the centre chamber is raised to incandescence by an air blast; and the producer gas so formed (and which consists of a mixture of carbon monoxide and nitrogen) is led down through the two side chambers containing the iron. By the time the fuel has been raised to the right temperature, the iron has also become red hot, partly by the heat passing through the division walls which separate it from the fuel, and partly by the impact of the hot producer gas. The air blast is then cut off, and superheated steam injected at the bottom of the iron chambers. Passing over the metallic surface this steam is broken up, with liberation of hydrogen; the iron taking up the oxygen of the steam and becoming converted into oxide. While this production of hydrogen is going on, oil is being injected in a fine spray, by means of superheated steam, into the centre of the incandescent fuel. The steam attacks the fuel, giving rise to a mixture of carbon monoxide and hydrogen, which dilutes and protects the oil that is being decomposed by the heat into permanent gases; any carbon which is deposited being left in the fuel, and being utilized there during the next process of blowing up. Superheated steam is also injected at the bottom of the fuel chamber, and this gives rise to a brisk uprush of water gas, which rapidly washes the oil gas made in the upper part of the chamber out of the incandescent fuel, and so prevents the hydrocarbons from being decomposed to too great an extent.

In several forms of water-gas apparatus, attempts have been made to introduce the oil into the fuel, and so to utilize the heat of the fuel chamber in decomposing the oil. But these attempts have all been failures, from the fact that the oil has simply been allowed to flow in, and the high temperature has entirely burnt it up, producing practically nothing but carbon and hydrogen. The injection of the oil by steam, however, prevents this taking place; as the steam will always attack the fuel rather than the oil, on account of its high temperature. The water gas produced forms a protecting envelope, which shields the gases formed from over-decomposition, and allows them to escape into the top of the generator, where they mingle with the hydrogen made in the side chambers, and pass away to the hydraulic mains and condensers. As soon as the temperature has fallen to the point at which carbon dioxide begins to appear in any quantity in the gas, the making is stopped; and the generator fuel is once more raised to incandescence by the air-blast. The producer gas is then led, as before, down through the iron chambers, and reduces the oxide of iron formed there during the making of the hydrogen back to metallic iron; at the same time raising its temperature to the point necessary for again making gas. In practice I have found that 5 to 6 minutes is as long as it is advisable to make the gas, as by that time the carbon dioxide has gone up to about 3 per cent., and any prolongation of the run would rapidly increase this proportion and entail extra expense in the purification.

It will be seen from this brief description of the plant that the gas is practically a mixture of oil gas, water gas, and hydrogen; and the result of working in this way is to reduce the carbon monoxide from 30 to 15 per cent., which I conceive to be a safe limit, even if the gas were sent out alone, without admixture, as would generally be the case, with coal gas. I find that the Russian "Solar Distillate" oil, which is the kind used at Beckton in the Lowe plant, answers perfectly well; but I can also use any oil which is sufficiently liquid to flow from the tank containing it to the injectors. The crude oils which it would be impossible to use in any other form of plant can, therefore, perfectly well be used in this; as the carbon and pitchy matters deposited by them, and which would choke any ordinary form of superheater, are left behind in the fuel, and afterwards burnt up there. Experience has also shown that there are practically no residuals from the process; and, like the Young apparatus, it yields gas and carbon only. The average working for several months at Aldershot gives 1000 cubic feet of 20-candle gas for a consumption of 3 gallons of Russian "Solar Distillate" oil and 35 lbs. of coke; the composition of the gas being—

Hydrogen	40·77
Saturated hydrocarbons, methane, &c.	29·20
Unsaturated hydrocarbons, ethylene, &c.	14·21
Carbon monoxide	15·15
Oxygen	0·13
Nitrogen	0·54
	100·00

These figures work out to 1333 candles per gallon. But on many occasions we have made 22-candle gas with 2·7 gallons, which means over 1600 candles per gallon; and as the apparatus used has been of the roughest description, and only worked intermittently, I am in hopes that the large generator I am erecting at the South Metropolitan Gas-Works will, when working continuously and at even temperatures, give the higher figure. An apparatus to make 250,000 cubic feet per 24 hours only occupies a space of 18 feet by 8 feet and 10 feet high; so that no exception can be taken to it on the ground of size. The cost of the gas may be reckoned as follows; taking the oil, as before, at 3½d. per gallon:—

Oil, 3 gallons at 3½d.	0s. 10½d.
Coke, 35 lbs.	0 2
Labour	0 1½
Charge on plant	0 0½
Purification	0 0½
	1s. 2½d.

We can now compare the cost of enrichment by the Young and by this process. We will take the case of a gas manager who can make 15-candle gas by the use of Durham coal, and put it in the holder at 1s. per 1000 cubic feet, but who has to send it out at 17·5-candle power, in order to ensure its testing above the 16-candle standard over a big district. In this example, 1000 cubic feet of 17·5-candle gas equals 3500 candles; and to obtain this he could mix 33·3 cubic feet of the Young gas with 966·6 feet of his 15-candle gas, the mixture costing him 13·33d. per 1000 feet. On the other hand, he might mix 1000 cubic feet of his 15-candle gas with 1000 cubic feet of the 20-candle gas, which would give him the 17·5-candle gas at 13·25d. per 1000 feet.

It will be seen from these figures that the cost of enrichment for the 2½ candles needed is practically 1¼d. in each case—a figure which will compare favourably for enrichment either with cannel or the Maxim-Clark process; and in considering which it would be most advantageous to adopt, the gas manager must be entirely governed by the cost of his original gas and the space at his disposal, as directly the cost of the coal gas rises above 1s., it becomes too expensive to use as a diluent for enriching by the oil gas, and enrichment by carburetted hydrogen at once begins to show a distinct advantage. For instance, if the 15-candle coal gas cost 1s. 2d. in the holder, the enrichment by oil gas would still cost 1¼d.; whilst enrichment by carburetted hydrogen would have fallen to ⅛d. So that the great field for enrichment by the Young process would appear to be in Scotland and the North of England, where the shale oil can (at any rate at present) be obtained cheaply; whilst I hope it will be found that in the South, and those districts where the carriage of coal has raised the initial cost of the gas, that carburetted hydrogen will prove a welcome means of enrichment and even in case of necessity of production.

The cost of erection is small. A generator to make 250,000 feet a day only costing £450. The specific gravity of the gas is almost identical with that of coal gas; so that our knowledge of the rate of flow through mains and meters, and the kind of burners which are best to use, will remain unaltered.

In using the Young gas as an enricher, special precautions will have to be taken to ensure perfect admixture with the gas to be enriched. The richness of the gas means that it has a very high specific gravity; and although theoretically diffusion should make it possible to produce a perfect mixture of light and heavy gases in a holder, yet in practice every gas manager knows the tendency which variations in specific gravity have to bring about "layering" in the holder, and to cause considerable variations in the quality of the gas sent out. But I should imagine that if the oil gas was to be mixed with the coal gas at the right rate of flow for enrichment, at a point between the scrubbers and purifiers, the passage through the latter would largely help in bringing about the desired result.

* The arrangement was shown in the JOURNAL for April 11, p. 644.

In this paper I have done my best to entirely divest my mind of any feeling in favour of either process, and present these remarks to you as an interesting chapter in the history of enrichment. In a paper which I had the honour of reading before the Incorporated Institution of Gas Engineers last year, I was forced by the strength of experimental data to a conclusion that no method of retorting oil alone could compete with processes in which the oil was decomposed in a current of inert gas. Mr. Young's admirable process, therefore, came as a most interesting surprise; as his enrichment figures show an enormous advance over anything yet produced by the Lowe or any other well-established process. The fact that in intermittent working with my process I have found it to give figures practically identical with those obtained by Mr. Young, also leads me to suppose that we are still far from obtaining the maximum amount of light possible from the oil. There is no doubt that in the Young process the formation of naphthalene and other hydrocarbons of the aromatic series, point to a loss of illuminating value due to prolonged contact with the heated sides of the retort; and it must be borne in mind that, although it may be possible to prevent the formation of benzene and naphthalene, yet that when once formed it is not possible to again break them up into permanent gases which have anything in any way approaching the illuminating value of the ethylene from which they were formed. In the same way I am quite convinced that, although my method of cracking the oils gives a higher value from them than any other rapid gas-making process, yet that there must of necessity be a considerable loss from the rough treatment to which they are subjected; and although the two processes I have to-day brought before you seem to me far the best at present existing, I also feel that the ultimate goal at which we all must aim is not at present reached.

The Electric Lighting of the British Museum Reading-Room.—Arrangements are being made for altering the lighting of the Reading-Room at the British Museum. The change will certainly be a welcome one to all who have to use the room for work. In addition to the arc lamps suspended from the ceiling, it is intended to introduce about 200 incandescent lamps, so distributed as practically to give a light to every reader. They will be placed on brackets on the tops of the ventilators which surmount the elevated partitions intervening between the desks of immediately opposite neighbours; and in this position they should afford necessary light without casting much shadow.

The Work of the Patent Office in the Past Year.—The report of the Comptroller-General of Patents for the year 1892 indicates that the number of applications under the International Convention amounted to 199—more than double the number a few years ago. The total number of patents issued annually has increased from 9984 in 1885 to 10,887 in 1892; while the number of applications has swelled in the same interval of time from 17,110 to 24,171. The gross income of the office last year was £199,859; and its gross expenditure. £96,822, which includes the outlay on the new offices and buildings. These figures give a surplus of £103,037. The annual instalments yielded about £98,058; so that, even if this sum had been deducted, the Patent Office would still have had a surplus of £4979.

Photometry at the Physical Society.—At the last meeting of the Physical Society, Mr. A. P. Trotter read a paper in which he described his new photometer, which is a modification of his illumination photometer, already referred to in the JOURNAL (see Vol. LIX., p. 1005), so as to adapt it to the measurement of candle power. The principle employed is to view a screen illuminated by one source through an aperture in a second screen illuminated by the other light; the aperture becoming invisible when the illuminations are equal. The photometer is found to be particularly valuable when it is desired to determine the maximum power of a variable source. When lights of different colour are being compared—say, a gas-flame and an arc—one end of the screen shows blue stripes on a yellow ground, and the other end yellow stripes on a blue ground; at the centre the colours seem to blend. Details as to the construction of the new photometer were given in the paper; and the accuracy attainable, when comparing the equal lights of (say) 8 candles, was stated to be about 1 per cent. On the same occasion, Professor Silvanus P. Thompson read some notes on photometry. The first one related to the use of two overlapping screens as an isophotal; and in it the author described the evolution of the Thomson-Starling photometer. The second referred to the periodic principle in photometry; and the author discussed therein the various methods which have been, or may be, used for producing small differences of decreasing amount between the two sides of a photometer screen. In a third note, the use of the electric arc as a standard of light was dealt with. A discussion followed the reading of the papers.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1170.)

THE condition of affairs in the Stock Markets is steadily—though slowly, it must be confessed—improving. The chief incident of last week was the settlement; and settlements recently have been exciting and perturbing episodes. This time, however, the business was got through satisfactorily; and the hammer was left at rest. The recent storms had cleared the air; few ultra-speculative accounts were open; and there was no dearth of money when wanted. Business, on the whole, however, is reviving very cautiously. There is little disposition to encounter much risk; and it is only among the high-class securities that there is any degree of activity, where the abundance of money must seek some investment. The Bank rate was lowered on Thursday from 3 to 2½ per cent.; and its reduction has thus been as rapid as its rise. Business in the Gas Market has been much quieter; the disposition to inactivity which marked the close of the preceding week being repeated last week, though there was some show of briskness in the earlier portion. The tendency was all in favour of higher prices; some of the chief stocks being specially buoyant. In Gaslights, the "A" was very firm, and, with active business, rapidly advanced in quotation; the last bargain being marked at 225, while even a higher figure had been previously touched. There was not much done in the debenture, preference, or secured issues; but some of the former improved in their quotations *ex div.* South Metropolitan, on the whole, have been rather quiet; and their prices are unchanged, though some dealings in "B" showed good figures. Nothing at all was done in Commercials; stock appearing to be scarce. There was very little business in the Suburban and Provincial undertakings; but they furnish the only instance of a fall in values—Alliance and Dublin having receded. The Continental Companies made a good figure—Imperial exhibiting a large advance; but a "special" bargain at the close was at a low price. Among the rest, there is no particular feature in evidence; but San Paulo made a recovery—the aspect of South American affairs being regarded as more promising. Business in Water was extremely quiet; but the tendency was better, and two or three stocks have slightly advanced.

The daily operations were: The Gas Market opened very firm on Monday. But business was not particularly brisk; and the only move was a rise of 1 in Imperial Continental. Tuesday was noteworthy for the activity of Gaslight "A," which almost monopolized attention, and rose 2. Imperial Continental also improved 1 more. Wednesday was a much quieter day; but prices, though not higher, were steady and good. On Thursday, the big issues had the field all to themselves—the smaller companies not being noticed; and the tide of value continued to rise—Gaslight "A" and Imperial Continental making an advance of 2½ each, while several other issues, quoted *ex div.*, showed improved figures. In Water, Grand Junction, Southwark and Vauxhall "D," and West Middlesex were quoted higher *ex div.* Everything in Gas dealt in on Friday kept very firm; but Alliance and Dublin, both issues, fell ½, without business marked. San Paulo advanced ¾. Southwark and Vauxhall ordinary went up 2. Saturday was very quiet; but quotations still rose—Gaslight "A" advancing 1; and Imperial Continental, 1½.

ELECTRIC LIGHTING MEMORANDA.

Dr. Silvanus Thompson on the Electrical Side of the Chicago Exhibition—The Cost of House-Wiring—The Cost of Bad Works' Lighting—The Low Salaries of Electricians.

A WELL intentioned attempt to revive the interest of English electricians in the Chicago Exhibition was recently made by Dr. Silvanus Thompson, in the shape of a paper read before the Society of Arts, under the title of "Practical Electrical Problems at Chicago." There is to be an Electrical Congress at Chicago, which Dr. Silvanus Thompson and other English men of science contemplate attending, at which a consensus of opinion is to be taken upon certain matters of great importance—such as the final adoption of international units and standards, as well as other questions of nomenclature or international interest. In view of this project, it might have been supposed that Dr. Thompson would have taken the opportunity of explaining how these matters stand at present, and of pointing out the lines along which an international congress might be expected to act most advantageously. Instead of this, Dr. Thompson took the surprising view that such a preliminary statement would be "ill-timed and discourteous;" and he went on to discourse upon the differences between American and English electric lighting practice, in a style that might be called interesting, but is hardly likely to earn the title of instructive. It is not uninteresting, for example, to hear that central electric lighting stations in the States make great use of belt-driving, whereas the English practice is in favour of direct coupled machines. But since this difference of system is observed and recorded, it can hardly be worth while to go to Chicago for the purpose of saying anything more about it. Again, it is quite true that an ugly electric light pole, having a transformer hung on

to it, where it brings the current to your house, is a sight which cannot be seen in England, simply because it does not exist; but where is the temptation to visit Chicago, in the reflection that there such things are common objects of the sidewalk? In house-wiring, too, practice differs. "Doubtless," says Dr. Thompson, "we shall at Chicago exchange opinions in many of the details of this highly practical question." It is a thrilling prospect; but, speaking as a gas engineer, we should hardly care to go so far in order to discuss points of internal gas-fitting. But then, of course, gas-fittings are so intensely unscientific; whereas the wiring of a house for electric lighting is very much the reverse.

The discussion upon Dr. Thompson's paper was as curious in its disregard of any satisfactory reasons why English electricians should go to Chicago in the Autumn as the paper itself. Mr. W. H. Preece was in the chair on this occasion; and, as usual, he delivered himself of a ponderous harangue about things in general. Among other matters that appeared to the Chairman as germane to the subject of the paper, was the cost of house-wiring, which was denounced as excessive. It was stated that in London the average cost of internal house-wiring is at present £2 or £2 6s. per lamp; and Mr. Preece declared that he shall not be satisfied until it is reduced to 20s. Why the "bonds eternal" should be set at this particular figure, does not appear from the argument. Mr. Preece opined that a yearly tenant of a house will not go to the expense of wiring at current prices, and a landlord who has his property occupied will not do so, with the result that the electric light is not introduced into houses occupied by yearly tenants. "When wiring could be done more cheaply, electric lighting would develop very rapidly, it having been now proved that electric energy could be supplied more cheaply than gas." It is vain to ask Mr. Preece to justify his statements; but it is a curious thing, if electric energy can really be supplied more cheaply than gas, that this is not done anywhere. According to this description of their little ways, electric light suppliers must be the wickedest of extortioners and deceivers; for while they continue to charge the public three or four times as much for their light as need be paid for equivalent gaslight, they effectually conceal from their shareholders the stupendous profits that ought to be derived from this way of doing business.

A remarkable case under the Employers' Liability Act was recently heard and decided in the Marylebone County Court, the point of which turned upon the difference between the provision of lights and lighting. The plaintiff, a labourer, claimed £100 damages for injuries received while in the employ of the defendants, who are engineers and ironfounders, on works in Carnaby Street, Regent Street, through falling into a hole which was not properly covered, owing to to the negligence of the defendants or their foreman. The negligence was alleged to consist in the defendants or their foreman not having discovered or remedied the dangerous condition of the hole, "or taken proper means to cover and light the same, and not having provided essential safeguards, or taken due and necessary precautions, taking into consideration the situation, condition, and system under which the works were carried on." The works in question consisted in the erection of an electric station; and the plaintiff had occasion to pass with a heavy bar of iron on his shoulder along two planks, with holes or pits in the ground on both sides. He was aware of the existence of the pit on his left, but not of that on his right, having been only a very short time on the work, and being ordered to do this particular job at 5 p.m., when it was already dark. "The electric light shed a strong light from the adjacent boiler-room over a wall 7 feet high; but the latter threw the hole on the right into partial or total shade." Consequently the man fell into this hole, which was some 15 feet deep, and sustained severe injuries. The jury awarded him £30 damages; and now, in all probability, when the same contractors want to erect an electric light station, they will use oil-lamps instead of electric arcs.

Complaint has frequently been made in the journals devoted to the electric lighting industry, of the low salaries that are offered by municipal corporations for the services of electrical experts as managers of central lighting stations. It has been pointed out that such a poor scale of remuneration brands the industry to which it is applied as an inferior employment. Even gas managers get more as a rule than the managers of central electric lighting stations; and partisans of the latter are puzzled at the spectacle of the starvation wages the scientific gentlemen who have made a study of electric lighting technics are ready to accept. The truth of the matter is that, while there is "no money" in electric lighting, and while its supply in a town is merely a concession to a fashionable taste, the essentially unprofitable nature of the work is sure to tell upon somebody; and for reasons that need not be enlarged upon here, that somebody is naturally the manager. Workmen must be paid full wages, interest on money must be found, coal and stores must be purchased at market rates. There is nothing which the electrically though frugally minded municipality can squeeze but the manager's salary; and they do it with a will.

Mr. Forbes Waddell, late of Tain, has now entered on his duties as Manager of the Blairgowrie Gas-Works, in the room of Mr. W. C. Bell, who has been compelled to resign through ill-health.

COMMUNICATED ARTICLES.

THE SUGGESTED FEDERATION OF GAS MANAGERS' ASSOCIATIONS.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

(*Concluded from p.* 1097).

Next in order of time came the expansion of the British Association of Gas Managers into the The Gas Institute; and this step, it was hoped, would induce directors, and perhaps even shareholders, of gas companies, to extend at least pecuniary support to its objects, which were considered to tend to the benefit of the gas industry at large, and not to be restricted to engineers or managers. By way of commencing upon the new scale of operations, an inquiry into the subject of condensation was carried out on a working scale, and the Gas Section of the Electric and Gas Exhibition at the Crystal Palace was promoted. A sum of upwards of £4000 was contributed by gas companies, in the course of a few months, for this purpose; showing that, if a definite object of a promising character is in view, pecuniary support is not wanting. But subsequent experience as to the amount of the annual donations from gas undertakings shows that these conditions are a *sine quâ non* to the obtaining of any substantial sum. There is a prevalent inclination to shelve applications of a general character only; and this point should not be lost sight of when preparing applications to boards of directors or gas committees. To some extent, there is now a change of front; and gentlemen who were most active in 1881 in the matter of enlarging the scope of the Institute, to include all interested directly or indirectly in gas-works, seem at present to favour returning to the British Association of Gas Managers order of things, and making the society a Gas Managers' Association only. Others feel that, when once persons have been admitted to membership, their names should not be struck out except on account of personal unfitness, or because they cease to hold the needful qualification of membership; and the adjustment of this point will be one of the greatest difficulties in the way of a unanimous federation.

One of the reasons why the various Gas Managers' Associations have, notwithstanding their steady growth, been cramped and blighted in their operations, is the apathy of a large number of members of the profession—larger than appears at first sight—towards them. Mr. Irving states that the District Associations muster a total of 760 members. The Gas Institute comprises 554; and the Institution of Gas Engineers, 118. But out of this total of 1432 in all, the majority are counted more than once. Most of the members of the Institute or of the Institution also figure on the roll of at least one District Association; so that the total number of individuals who are members of at least one Association does not exceed 800. This is the number who are so far interested in Associations as to pay a subscription—or rather to promise to pay one, which is a different thing; for the loss by bad debts is considerable in all the Associations, and the annual income falls considerably short of the sum arrived at by multiplying the number of members by the subscription fee. When we come to the permanently active working members who keep the thing going, a very great deduction must be made. To begin with, it is not too much to say that a very large proportion of the noble 800—possibly one-half—have never been heard at a meeting. They had not the time—which in most cases means that they had not the inclination—to write a paper or to join in a discussion. Going a little further, it is not necessary to travel outside our profession for representatives of a single-speech Hamilton—gentlemen who appear at one meeting only and are not afterwards heard of. They usually have some special purpose in view other than the good of their Association, which merely fits their purpose for the time being as a platform for ventilating some pet hobby or pretty little invention. Others do not come upon the scene except when there is a chance of contradicting someone else, when they rise to the occasion with an energy worthy of a more important cause. Thinning out till only the hearty and disinterested workers, upon whom devolves the active exertion of keeping up the prestige of our two general and eight local Associations, are left, we have a very small band indeed—perhaps less than a hundred. This fact, of itself, though not creditable to the rank and file, is a strong argument in favour of union. A small force should always be arranged to the best advantage, and should not be spread over too great an area of ground. So the efforts of this small body would show a greater degree of success if they were strengthened by bands common to all, than they do under present circumstances.

In theory, it is always assumed that each and every member is in a position, and is willing to take a fair and equal share, in carrying on the work of his Association. The rules and general order of proceedings are all based on this assumption. But, in practice, some really are unable to help their Association much. From one cause or another, which need not be further enlarged upon, their hands are really tied. A still larger number have not the inclination to sacrifice any important amount of time. They do not mind a Committee meeting once a year, besides the regular meetings; but they do not want to have the thing always on their minds. So the real carrying on of the work falls

upon a devoted few; and if difficulties arise on account of this practical perverseness from the theoretical basis of the Association, the cause should be clearly recognized. But this is rarely done. If a complaint is made, it originates amongst the silent ranks; and the author maintains his accustomed obscurity. If fault is found with the proceedings, it almost always comes from someone who was not present on the particular occasion, and moreover does not make a practice of attending. It comes out as a piece of gossip from no one knows where, and grows until at last someone bursts out in a letter to the press. But it does not take the form of an address to the silent and careless ones, urging them to be up and doing and to take more interest in their Association. No. It is usually a more or less weak personal critique upon one or more of the prominent workers, who prefer a right and just cause to a popular one, or who do not happen to be in favour at the time on account of personal reasons. But the real cause of defect, if any exists, generally admits of being traced back to the reticence of the complainer and his friends, with the consequent result that the burden which is supposed to be distributed with tolerable fairness over the whole contingency, falls on the shoulders of two or three.

Any scheme for increasing the influence and the advantages accuring from Gas Managers' Associations, which I take to be one of the main objects of the Scheme of Federation, must take into consideration this large majority of lukewarm or totally indifferent members, and of those who at present hold off altogether, and the feasibility of doing anything that will draw them into the ranks. Any increase of usefulness must necessarily tend to increase of attractiveness, and therefore of members. There is no reason why the scanty muster-roll above instanced should not be doubled, and more than doubled. Other technical societies boast their 3000 or 4000 members; so why should not a federated Gas Institute muster at least 2000? Of course, some may object that those who are not attracted by the present arrangements will hold aloof from anything of the sort, federation or otherwise. But the test is worth making.

Another factor that tends to limit the operations of Gas Managers' Associations, and will always tell against them so long as they remain within the present dimensions, is the competition of the press. Much of the work which they aim at doing is done, and was done for years before District Associations were in existence, by our technical serial publications. These have gradually been improved and developed until they fill a certain department in a better and more popular manner than any Association can hope to do. The success of the Society of Chemical Industry has been due, in a large measure, to its excellently arranged *Journal*, which comprises a great deal beyond the accounts of the papers read and discussed at the meetings—including abstracts from the patent list, extracts from periodicals, and a great deal of useful technical inform ation. But no Gas Association can look in a similar direction for increased popularity, because the JOURNAL OF GAS LIGHTING has for many years occupied the ground, and done as much for the gas industry as the *Journal of the Society of Chemical Industry* has done for applied chemistry. There is scarcely a subject which it does not cover. Parliamentary and legal intelligence, patents, new processes, stock and share lists, meetings of companies, proceedings of chemical and engineering associations, as well as those of gas engineers, abstracts of everything interesting from foreign sources, and general news, are all to be found within its columns; and it usually steals a march on the authors of papers in the matter of novelties of every kind. It is not to be wondered, then, that some find the weekly publications to be a sufficient communication with the outside world. So Gas Managers' Associations must offer some solid advantages in addition to, and in a different field from, that afforded by the technical press, which is now so firmly established as to be, in a limited sense, a rival to it. Supposing for a moment that there was no JOURNAL OF GAS LIGHTING, and that there was a "Journal of the Gas Industry" issued periodically under the auspices of The Gas Institute. Would not many who at present hold off be only too eager to join, if only for the purpose of obtaining a copy of the Journal? In alluding to this point, I should not be misunderstood as wishing to infer that the existing order of things is a mistake, or that the work of publishing a Journal is one that could be satisfactorily carried on by a Gas Managers' Association. I entertain a decided opinion to the contrary; for the members of such an Association do not include parallel representatives of the gentlemen who carry on the *Journal of the Society of Chemical Industry*. It will be better for Gas Associations to leave the publishing of news to the sphere where it is now so efficiently carried on. What is the use of publishing bound reports and Association proceedings, at the expense of the Association, when these reports have already appeared in our serial literature? It would be worth while to take a vote on this point.

The members of Gas Managers' Associations are all busy men, and, further, are continually at work. They have no "long vacation," as represented, in one form or another, in many other professions; and many of them never knew such a thing as a month's holiday since the time they commenced business life. A retired gas manager is a rarity; for the majority fall while still in active duty. Many find it desirable, in addition to supporting their own technical Association, to identify themselves with chemical and engineering societies, so as to keep in touch with the general advancement in the matter of technical education, which is so marked a feature of the present day. So there is every reason why the benefits of association should be secured to each and every member at the least possible expenditure of time and money. The annual subscription to two or three Associations may not, of itself, be an important item; but the duties of membership involve travelling and other little expenses besides. When it is remembered, in addition, that the active professional man is essentially one of those to whom "time is money," it is evident that the cost of belonging even to only one District Association is not inconsiderable. If one hears at a meeting a repetition of matter which he has already heard at another, he is simply paying twice over for the same thing.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

IN THE LABORATORY.

Testing Gas.

(*Continued from p.* 1042.)

The various apparatus employed, and the methods to be observed, in carrying out a test, are fully set forth in the Referees' "Instructions," already referred to. These may be found in full in "King's Treatise on Coal Gas," in Newbigging's "Handbook," Dibdin's "Practical Photometry," and other works; also in a pamphlet by Mr. W. T. Sugg. It is therefore unnecessary to occupy space by recapitulating them here. The same remark applies to testing for impurities, which, with one exception—carbonic acid—is fully dealt with in the first two and the last of the publications just named.

The compound just mentioned is looked upon less in the light of an impurity than as a serious diluent; its presence in coal gas very prejudicially affecting the illuminating power. In support of this statement, one more quotation from Professor Lewes's second Cantor Lecture must be allowed. Experimenting with ethylene, having an illuminating power of 68·5 candles, the decrease in luminosity in accordance with the percentage (volumetric) of carbon dioxide added was as follows*:—

Percentage of Ethylene.	Percentage of Carbon Dioxide.	Candle Power per 5 c. ft. of Gas.
100·00	nil.	68·50
93·68	6·32	55·52
90·59	9·41	51·81
89·03	10·97	49·98
81·73	18·27	42·81
70·75	29·25	33·23
64·14	35·85	26·52
52·94	47·06	14·72
45·61	54·39	7·49
40·00	60·00	0·60

The methods of testing for carbonic acid are given fully in the paper upon testing crude gas.† Carbonic oxide, which is also a diluent, is likewise present more or less. It may be tested for by absorption with an acid solution of cuprous chloride; but the test, being very unsatisfactory, is not much used.

Testing Ammoniacal Liquor.

There are at present in use three methods of testing ammoniacal liquor—viz., the specific gravity test, the saturation test, and Wills's distillation test. The first-named test is based on the assumption that the higher the specific gravity of the liquor, the greater the amount of ammonia therein contained. This is true only as regards such ammonia as may be present, as a salt, in combination with other compounds. Owing, however, to the great affinity of this gas for the sulphur and other acid impurities of crude gas already noted,‡ the bulk of the ammonia of ordinary gas-works liquor is thus combined, and the test is therefore—although but very crude and rough-and-ready at the best—not altogether valueless. What free ammonia may be present in solution (if any) will affect the test adversely to the producer; directly, as—though present—it is not indicated, and indirectly, because it reduces, instead of increases, the specific gravity of the liquor. The pungency of the liquor is principally due to the fact that most of the salts of ammonia, such as the sulphide and the carbonate, are exceedingly volatile. Hence also the necessity for keeping liquor-wells covered in.

Twaddel's No. 1 hydrometer is usually employed for testing ammoniacal liquor by this method. The scale on its stem is divided into 25 parts; each degree being equal to 5 degrees of gravity in 1000. Hence, to ascertain the specific gravity of a liquid by this instrument, multiply the number of degrees it indicates by 5, and add 1000 to the product. Thus, ammoniacal liquor of 5° Twaddel = 5 × 5 + 1000 = 1025 sp. gr. Now, 1 gallon of distilled water (sp. gr. = 0° T.) weighs 10 lbs. Each degree Twaddel represents 350 grains above the weight of distilled water. Consequently, 5° T. will represent 1750 grains, or 0·25 lb.; and 10° T., 3500 grains, or 0·5 lb. Hence, 1 gallon of 5° T. liquor, 1025 sp. gr., equals 10·25 lbs.; of 10° T., 1050 sp. gr., 10·50 lbs.; and so on. It will thus be seen that the weight of liquor in pounds avoirdupois per gallon is obtained by placing the decimal point after the first two figures of the number representing the specific gravity. Lastly,

* See JOURNAL, Vol. LVI., p. 1196. † *Ibid.*, Vol. LX., pp. 549, 727.
‡ *Ibid.*, Vol. LX., p. 155.

each degree Twaddel represents, very nearly, a strength in ammonia sufficient to saturate 2 oz. of standard acid of the saturation test. Hence, liquor of 5° is said to be 10-oz. liquor; of 7° or 10° T., 14-oz. or 20-oz. liquor. Liquor under test with the hydrometer should be at a temperature of 60° Fahr.; otherwise the readings will not be correct.

The saturation test is effected with a solution of sulphuric acid of 1064·3 sp. gr. (F. W. Hartley gives 1063·5 sp. gr.), which is added, drop by drop, from an alkali meter, into a measured quantity of the liquor under test. The solution is prepared by mixing 1 lb. of strong acid (1845 sp. gr.) with distilled water till the solution measures 1 gallon at 60° Fahr. Repeated trials are made during the test, by immersing blue litmus paper in the liquid, to ascertain when sufficient acid has been added to neutralize all the available ammonia present. When this is the case, the amount of acid used is read off the alkalimeter scale; and according to the number of divisions which are there indicated, the liquor is said to be of so many ounces strength—*i.e.*, to require so many ounces of strong acid (1845 sp. gr.) to neutralize a gallon of the liquor. The test is very unsatisfactory, and not worth the trouble of making, as, if there should be ammonia present in combination as a salt such as is not decomposed by sulphuric acid, it is not indicated by the test, and is lost to the producer. This is the case when ammonia is present as sulphate, as sulphocyanide, and other salts in solution; and, in the writer's opinion, the existing methods of gas purification, also of maintaining a slight vacuum in the retorts, involve the almost certain presence of more or less oxygen with the gas in the scrubbers, and are thus very favourable to the formation of sulphate of ammonia in the scrubber liquor—thus rendering the manufacturer more liable to loss by this test than was the case in past years. Mr. Leicester Greville pointed out this source of error quite as far back as the year 1874.

Wills's distillation test is as follows: Three test solutions are employed—a solution of caustic soda (1 oz. by weight of soda to 9 oz. of distilled water); sulphuric acid solution (1064·3 sp. gr., and prepared exactly as for the saturation test, as already described); and ammonia solution of such strength as to neutralize an equal measure of the acid solution. Equal measures (2 oz.) of these two solutions are used in the test, which would therefore exactly neutralize each other. To make a test, a fluid ounce of liquor is run through a sealed funnel, inserted into a double stoppered flask, which, protected by a sand bath, is placed over a Bunsen burner. To the liquor in this flask is added an equal measure of the soda solution, for which the acids of the salts in the liquor have a stronger affinity than for the ammonia. The latter will therefore, on application of heat, be wholly expelled. The mixture is then raised to the boiling-point, and kept so for some 15 minutes, by which all the ammonia is driven off, and passed through a tube inserted at one end into the flask stopper, the other end being sealed in sulphuric acid solution (2 oz. in quantity) contained in a second flask. The ammonia is readily absorbed by the acid as it leaves the boiling liquid; and when the whole of it has been driven off, the acid flask is removed, cooled, and the contents coloured with tincture of hæmatine. A burette having been charged with 2 oz. of the ammonia solution, the latter is now allowed to drop slowly into the flask, until the liquid changes to a purple colour; thus indicating that the whole of the 2 oz. of test acid originally taken has been neutralized with ammonia. The quantity of solution remaining in the burette represents the amount of ammonia which has passed over from the liquor under test, and become absorbed by the acid; and according to the number of divisions indicated on the burette (each 1-16th oz.), so the liquor is said to be of so many ounces strength—*i.e.*, to require so many ounces of strong sulphuric acid (1845 sp. gr.) to neutralize a gallon of the liquor. The test is practically a saturation test, with this difference—that the means adopted ensure that the whole of the ammonia contained in the liquor, whether "fixed" or not, is driven out, and indicated in the test.

The writer is indebted to Mr. Newbigging's "Handbook" for some of the particulars and quotations given above, as well as to the *brochure* on "Ammonia Liquor Tests" by the late Mr. F. W. Hartley—a book which, unfortunately, has long been out of print.

The Pollution of Rivers.—In the House of Lords last Tuesday, Viscount Cross called attention to this subject. He stated that experience had shown that there were very great difficulties in the working of the Rivers Pollution Prevention Act, 1876, and that not nearly so much had been done under it as ought to have been accomplished. The County Council of Lancashire, finding it was impossible to work the Act effectively, last year obtained a Private Act for the more effectual prevention of the pollution of the Mersey and its tributaries. Much good had resulted from this Act; and, as he was desirous that the whole country should have the benefit of it, he presented a Bill drawn on precisely the same lines, but with some small alterations, for which he asked a first reading. Lord Norton, in supporting the Bill, exemplified the necessity for such a measure by referring to the proceedings in the Lower House in the preceding week, when a Bill having for its object the prevention of the pollution of the Avon was rejected. The Bill was read a first time.

TECHNICAL RECORD.

THE MIXING AND STRATIFICATION OF GASES.

In a recent number of the *Journal für Gasbeleuchtung*, an article appeared on the above subject, by Herr W. Leybold, of Frankfort-on-the-Main. The author has kindly forwarded to us a print of the article in pamphlet form; and the following is an abstract translation thereof.

Dalton was the first to notice that gases which have no chemical action on one another when in superimposed layers mix completely within a short space of time, even though they may be of widely different densities. This subversion of the ordinary results of gravitation was observed more closely by Berthollet, and afterwards by Loschmidt and Graham, the latter of whom applied the term "diffusion" to the phenomenon. He, however, experimented with small volumes of gas only, and caused the gases to pass through a septum of plaster of Paris or graphite, instead of permitting free contact. Dalton had used long and narrow tubes as connections between the vessels containing the gases under observation. No regard has been paid to the effect of temperature on the diffusion of gases; and it is probable that, in the experiments of these observers, the gases were at the same temperature. This article shows that the conditions of temperature obtaining exert a very considerable influence on the times of diffusion.

The ordinary processes of gas manufacture present the conditions required for an investigation of this subject, as gases are collected and stored in vessels of varying and often considerable capacity. In a gas-works, it is well recognized that gases do not mix with the rapidity commonly supposed; and in some cases one variety only of coal is used, in order that the gas may be of as uniform a density as possible. Where Bohemian, English, and other rich coals are employed in small quantities to improve the quality of the gas, they are frequently mixed with the ordinary coals before being charged into the retorts; and thus the gases mingle from the moment of evolution. In other works, however, they are carbonized in separate retorts, in order not to mix the coke; and then the gases first meet in the hydraulic main. The indisposition to mix freely is best observed in works where gas from a poor coal is enriched by cannel gas, which is of high specific gravity and illuminating power. In such a case the gases are in contact through the considerable length of apparatus from the hydraulic main to the exhauster. The latter, by its churning action, undoubtedly mixes them; and the purifying vessels are also excellently adapted for this purpose. Consequently, the gases might be expected to be thoroughly mingled in the holder. But the specific gravity of gases from different kinds of coal varies immensely, and, further, it varies according to the time that has elapsed from the charging of the retort; so that a rich Australian cannel gives, at one stage of carbonization, a gas of ·797 sp. gr., while a poor coal, when nearly burnt off, yields gas of ·305 sp. gr. In addition, the gasholders themselves often present conditions unfavourable to the mixing of gas.

There is frequently a considerable difference between the temperature of the newly-made gas entering the holder, and the external air. The air may be either warmer or colder than the entering gas. In winter the gas in the holder in the early morning will be cooled to the outside temperature (say, −15° C), and will have parted with its heavier hydrocarbons through condensation at the low temperature, and thereby have lost in illuminating power. Freshly-made gas of high illuminating power going into the holder does not raise the illuminating power of the issuing gas, in consequence of stratification and separation according to specific gravity taking place in the vessel. The entering gas, at from 12° to 15° C., is specifically lighter than the gas in the holder, and rises to the top; consequently, the old gas only is for some time delivered from the exit-pipe, and produces a bad light. Suddenly, however, the bad gas is replaced by the freshly-made gas giving a good flame; and the ordinary illuminating power is exceeded. Under the conditions cited, there is a difference of temperature of 30° C. between the new gas entering the holder and the gas within, which has been cooled to the outside temperature; and mixing does not ensue until the new gas has become considerably cooled. It has been proved that layers of gas may remain in contact for several hours before mixing.

In the summer, the converse of these conditions obtains. The heat of the sun may raise the temperature of the holder and the contained gas to 40° C., while the condensers will have brought the new gas down to 15° to 20° C.; and consequently this, on entering, remains at the bottom of the holder. The heavy hydrocarbons separated from the gas in the winter have been gasified, and have further enriched the gas in the holder. On working from it, the new gas only is at first obtained; but suddenly the illuminating power rises considerably as the old enriched gas is being delivered. Under these conditions also complete mixture ensues only after the lapse of several hours. In spring and autumn, the difference in temperature of the gas entering and the gas contained in the holder is slight. Mixture readily takes place; and the illuminating power is constant.

In the ordinary method of gas making, if a considerable number of retorts are charged hourly, no great variation in

the specific gravity and illuminating power of the gas entering the holder is observable, though an hourly rise is just perceptible. But if the whole number is charged at once, and allowed four hours for working off, important differences are noticeable in the specific gravity and illuminating power of the gas; and it requires considerable time to mix. In such a case, the light poor gas collects at the top of the holder, while the heavy rich gas remains at the bottom. In one instance, where 40 retorts were charged at one time with Westphalian coal, and allowed four hours for working off, hourly tests on the outlet of the holder showed that mixing was not complete until six hours after the charges had been drawn.

These observations prove conclusively that the general opinion that gases mix rapidly is not correct. The mixing of gases requires a certain and often considerably protracted time; and the conditions of temperature may greatly retard the process. But how is the problem of removing the conditions unfavourable to mixture to be solved? A horizontal wheel, with wings attached, revolving in the holder presents difficulties in working, and has proved ineffective. Great variations of temperature of the gas within the holder may be avoided by jacketing it, as has been done in some towns, and gas of uniform quality delivered. The diminution of illuminating power in cold weather may also thereby be avoided. It is beside the present question to consider the positions of the inlet and outlet pipes in the holder; and the fables as to the separation of gases may be disregarded. They doubtless originated in stratification; and the gases supposed to have separated had never really mixed. The separation of heavy hydrocarbons from gas is an instance merely of the removal of a liquid by condensation.

Cornwall County Fisheries Exhibition.—In connection with this exhibition, which will be held in Truro from the 25th prox. till Aug. 16, the Truro Gas Company have made arrangements for the delivery of cookery lectures daily, with the object of demonstrating the utility of gas for lighting, heating, and culinary purposes. The Company will have a representative collection of gas appliances on view at the exhibition.

Barrow Gas and Water Supply.—At the last meeting of the Barrow Town Council, Mr. Alderman Strongitharm, in moving the adoption of the proceedings of the Gas and Water Committee, reported a decrease of £1100 in the receipts for gas, and an increase of £500 in the revenue from water in the past financial year. The construction of a new reservoir by the Barrow Corporation at Harlech is to be pushed on with all speed; the scheme having received the sanction of the Council. The contract has been placed with a local contractor; and the cost is put down at £21,986.

Complaint as to the Tonbridge Gas-Works.—The Tonbridge Local Board having appointed a Committee to investigate an allegation as to the emission of unpleasant odours from the gas-works, the Secretary and Engineer to the Gas Company (Mr. Wilton) invited an inspection of the works. The invitation was accepted; and last Wednesday night the Committee reported that they were satisfied all practical means for the prevention of disagreeable smells had been adopted, and it was hoped that, when additional purifiers had been erected, the trouble would be reduced to a minimum, as the Company had expressed the desire to meet the wishes of the Board in every possible way.

The Management of the Blackpool Gas-Works.—At the last meeting of the Blackpool Town Council, a discussion took place with regard to the proposed increase in the wages of certain clerks in the Gas Department. The Committee confirmed the action of the Gas Manager (Mr. J. Chew) in the matter; and Alderman Parkinson, in moving the adoption of the minutes, said it was advisable they should adhere to the practice of leaving these matters to the Manager. Mr. Smith asked if it was the intention of the Corporation to allow each Committee to raise the wages of clerks in their respective departments. He objected to the Gas Committee having more power than the others in this respect. Alderman Parkinson replied that what Mr. Smith referred to was a part of the Manager's duties. Mr. Chew engaged the whole of the staff; and if the Committee began to interfere, they would mix up matters to the detriment of the gas management. Mr. Hampson took exception to the course adopted by the Committee. The minutes were confirmed.

An Abortive Action against the Eastbourne Gas Company.—At the Eastbourne Police Court yesterday week, the Gas Company were sued by Mr. T. W. Chester, of Bedford Well Road, for penalties in respect of their alleged neglect to provide the requisite communication for the supply of gas to his premises; the contention being that the neglect continued, after due notice, from the 5th to the 24th of May, and that the Company had incurred penalties amounting to £38, or £2 a day. It appeared from the evidence that complainant wrote to the Company on April 19, requesting that a supply of gas might be laid on to his premises. The next day he received a reply from the Secretary (Mr. J. H. Campion Coles), informing him that, if he would call and sign the application book, and have a proper box fixed at the entrance to his premises for the reception of the meter, the gas should be immediately connected with the existing pipe. The pipe was one running from the outer wall of the premises, through the garden into the house. It was submitted, on behalf of the plaintiff, that neither of the requirements mentioned by the Secretary were legal. Mr. Chester, in responding to Mr. Coles's letter, said: "I am writing to my Solicitor to-night to obtain a copy of the Act of Parliament under which your Company is incorporated, when I will write again." No further communication took place; and on this point the case was dismissed, with costs against the plaintiff—the Bench holding there was no "wilful failure" on the part of the Company to give a supply of gas, as Mr. Chester had himself left the matter open, by saying that he would refer to the Act, and then write again.

REGISTER OF PATENTS.

Gas Motor Engines.—Magee, J., of Belfast. No. 9674; May 21, 1892.

This invention relates to gas motor engines in which the combustible charge is compressed by the piston. The main objects the patentee has in view are to simplify the construction of these engines, to construct an improved means of igniting the charge both to start and work them, and an improved means of obtaining a combustible charge to start these engines, and to construct an improved means of governing them.

To accomplish these objects, he employs a cylinder and piston connected to the crank in the usual way; but no gear wheels or intermediate shafts are used to operate the exhaust and ignition valves. These are actuated by the motor piston and a diaphragm or small piston in communication with the pressure in the cylinder and suitable valves actuated by these means—all or part of these valves being operated by a cam or cams on the crank-shaft. To fire the charge, there is a straight pipe or passage heated at any convenient part; and, at the end of this pipe farthest from the cylinder, is a little valve to admit air and gas, drawn through the hot part of the pipe to ignite the charge in the cylinder. To start and work the engine, two straight pipes are employed for firing; these pipes being placed in suitable positions. A U or V shaped pipe or passage is used to fire the charge to start and work these engines; both ends of this pipe or passage opening into the cylinder—the openings being covered and uncovered at certain times by the piston, or by suitable valves actuated by the piston, or by cams on the crank-shaft. To allow the burnt gases to escape from the cylinder, a diaphragm or small piston and a non-return valve are employed; and a small opening is formed in the cylinder near the end of the travel of the piston nearest the crank. This opening permits a portion of the burnt gases to pass to the diaphragm or small piston, and the non-return valve prevents it escaping to the cylinder again. When the motor piston is full out, another opening in the cylinder is uncovered, which allows the pressure to escape to the atmosphere. Then the diaphragm or small piston acting on a lift-valve by means of a lever or direct, holds the lift-valve open while the piston makes its in-stroke, and drives out the remaining products. When the piston has reached the end of its in-stroke, a little opening from the diaphragm or small piston, uncovered by the motor piston or by any convenient means, allows the pressure to escape from the diaphragm or small piston, and the lift-valve closes by its weight or a spring. Another means of firing the charge is a flame placed near an opening into the cylinder; this opening being at or near the middle of the part of the cylinder travelled by the piston, and having a small valve opening inwards. To obtain a combustible charge to start these engines, the piston is caused to travel half an out-stroke more or less, drawing air and gas into the cylinder through an automatic valve, or the gas may be passed into the cylinder after the piston is at half-stroke more or less. To govern the engines, valves to admit air are placed in any suitable position in the cylinder; and they are actuated by the speed of the engine in such a way that, when the engine goes too fast, more air and less gas or mixture is admitted to the cylinder.

Water-Mains and Water-Service Pipes.—Pick, W. H., of Bradford. No. 12,071; June 29, 1892.

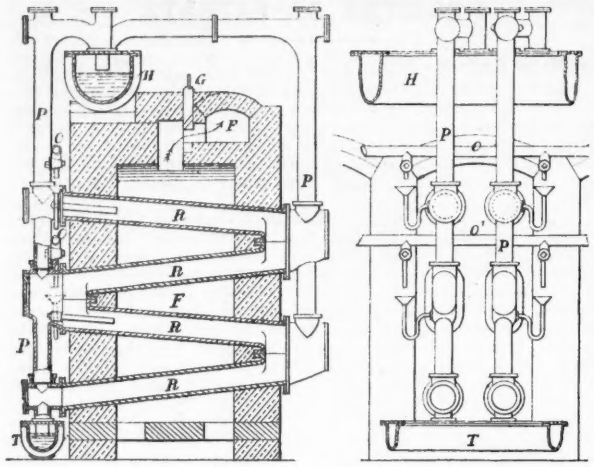
This "invention" relating to water-mains and water service-pipes for supplying and distributing water for domestic purposes has for its object "to preserve the water flowing through the pipes from contamination by contact with the inner metallic face of the pipe;" and for this purpose the patentee proposes to employ, "by preference, iron or steel pipes, and insert an inner or lining pipe of glazed earthenware, secured in position by grout or cement."

Manufacturing Oil Gas.—The Northern Counties Hydro-Oxygen Gas Company, Limited, and P. B. W. Goble, of Manchester. No. 12,924; July 14, 1892.

In the provisional specification as to this invention, it is pointed out that it relates to a construction and arrangement of furnace and retorts for producing oil gas—such that the oil supplied to the retort is cracked at an even low temperature, and that the produced gas is discharged directly and rapidly from the retorts. For this purpose, each group of retorts consists of three or four, each placed at an inclination in the flue, and connected at its end to the next retort above it. This is similarly inclined, but in the opposite direction; so that the three or four retorts thus combined form together a zig-zag channel. The oil is supplied (preferably) by a pipe or pipes projecting some distance into the highest retort, which is downwardly inclined from the end at which the oil enters. When there are four retorts, it may also be supplied to the second from the top, which is likewise downwardly inclined. From the lowest end of the lowest retort, there is an outlet into a receptacle for the tarry residue. From this receptacle on the one side of the furnace, and from a similar receptacle on the other side, a pipe ascends above the furnace; and both these pipes join a cross-pipe, from which a branch dips down into a hydraulic main. To these two pipes there are branches from the ends of each pair of retorts, by which the gas is led directly from the retorts as it is produced. Such oil vapour as may accompany the gas becomes condensed in the ascending pipes; and the condensed oil descends into the receptacles at the bottoms of the pipes. These receptacles are from time to time emptied; and the oil separated from the tar is again fed to the retorts. A number of sets of retorts, as above described, are arranged side by side in furnace compartments—two or more of the sets in each compartment—all of which are heated preferably by the combustion of gas generated in a producer below.

The apparatus is arranged as shown in transverse section and partly in elevation in the illustration on the next page.

Each group of retorts R consists of four, each placed at an inclination in the furnace chamber, which is supplied below with flame and hot products of combustion from a gas or other suitable furnace. Each retort is connected at its end to the next retort above it, which is similarly inclined, but in the opposite direction. The oil is supplied



direct to the hydraulic main H; being retained therein at a constant level. From this it is drawn off at any convenient position; and it passes by an oil-main O into a funnel, communicating by a syphon-bend with a pipe projecting some distance in the highest retort. This is downwardly inclined from the end at which the oil enters; and oil may also be suplied, as shown, from another oil-main O^1, connected with the hydraulic main to the third retort, which is likewise downwardly inclined. From the lowest end of the lowest retort, there is an outlet into the hydraulic main T, forming a receptacle for the tarry residue, and for such residues as may be condensed from the vapours in the vertical pipes. From this receptacle on the one side of the furnace, and from the lowest retort on the other side, pipes P ascend above the furnace, and join a cross-pipe, from which a branch dips down into the hydraulic main, but not deep enough to enter the oil in it. The two pipes P communicate freely with the ends of the retorts, so that the gas is led by these pipes directly from the retorts as it is produced. Such oil vapour as may accompany the gas becomes condensed on coming into contact with the surface of the oil in the hydraulic main, and, mixing therewith, is fed into the retorts. The receptacle T has, in any convenient part of its length, an outlet below the water for tar subsiding under the water.

A number of sets of retorts (as above described) are arranged side by side in furnace compartments—two or more of the sets in each compartment, all of which are heated preferably by the combustion of gas generated in a producer below. The flame and hot products of combustion pass through an opening in the roof of the furnace chamber into the flue F, and thence to a chimney; the draught through each furnace chamber being regulated by a damper G.

The claim for the invention is as follows: "Apparatus for manufacturing oil gas, consisting of groups of retorts arranged one above the other in a furnace chamber, each inclined and communicating with the next, so that all of each group form a zig-zag passage, some or all of the retorts having oil-supply pipes projecting into them, and all the retorts communicating at their ends with pipes ascending to a hydraulic main."

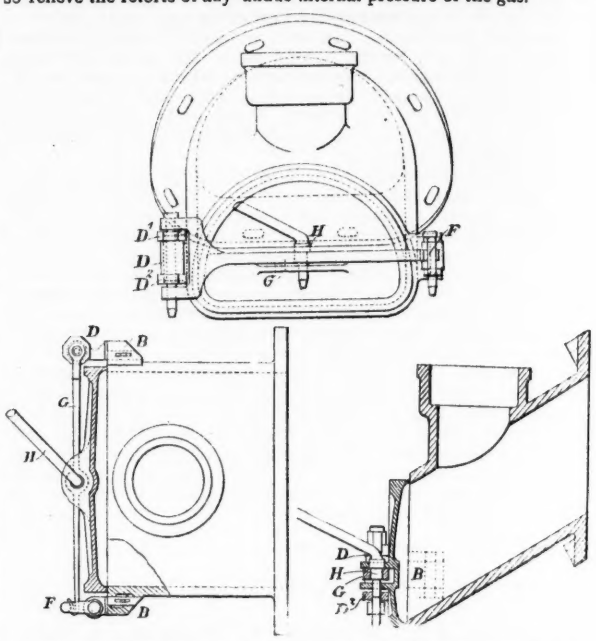
Gas-Engines.—Davy, D., of Sheffield. No. 13,077; July 16, 1892.

This invention relates to engines in which the power is obtained by the explosion of a mixture of compressed air and gas or other inflammable mixture. Two cylinders are employed; one being an explosion cylinder, the other an air cylinder—placed one inside the other. The inner piston is turned somewhat less than the bore of its cylinder; the outer piston being made to fit its annular cylinder, and provided with suitable packing-rings. In operation on an outward stroke, the inner piston commences to draw in a charge of gas and air; the outer piston at the same time drawing in a charge of air only. In returning, the contents of both clinders are compressed in their respective cylinders; the contents of the outer cylinder being compressed to a slightly higher pressure than the contents of the inner cylinder, in order to stop any leakage from the inner to the outer cylinder that might occur on account of the inner piston being less in diameter than its cylinder. At the end of the compression stroke, the mixture in the inner cylinder is fired; and the outward stroke is made by the expansion of the gases in the inner cylinder, and the expansion of the air in the outer cylinder—the latter being due to the heat absorbed by the compressed air during the passage of heat through the sides of the explosion cylinder. Any leakage, on account of the inner piston being less in diameter than its cylinder, simply increases the pressure in the outer cylinder without any loss. At the end of the stroke, the exhaust-valves are opened; the exhaust from the outer cylinder being made to pass through the explosion chamber of the inner cylinder; thereby clearing out most of the products of combustion. The cycle is then repeated.

Retort-Lid Fastenings.—Terrace, D., of Middlesbrough. No. 2985; Feb. 10, 1893.

This invention relates to retort-lid fastenings for use on inclined or horizontal retorts, and for other similar purposes; and it has for its object so making the cross-bars of faced lids and mouthpieces of retorts used in the manufacture of gas as to be flexible, instead of the rigid form generally in use, also of mechanical means for their adjustment, by having eccentric caps on fixed parts of the hinges.

The cross-bars G may either be made of forged steel, cast steel, or other suitable material; but their depth and thickness are to be such as to resist the usual pressure in gas-retorts, making a gas-tight joint, and at the same time admit of any easy sliding motion of the lid on the face of the mouthpiece, so that should any grit or tar get between, it would be readily rubbed off by the action of the hand-lever H and eccentric motion of the cross-bar. Another advantage of the spring-like pressure of the cross-bar as against rigid pressure is that, in case there may be any obstruction preventing the free egress of gas from the retort, the gas would issue between the mouthpiece and the lid, and so relieve the retorts of any undue internal pressure of the gas.



Another part of the invention is to make the hinged parts D, D^1, and D^2, and the fastening of the cross-bar, in such a manner that they can be readily adjusted, although the mortise B for receiving the hinged lugs in the castings are not cast quite true. The fixed part of the hinges may be so adjusted that twisting or setting of the neck of the hinge D may be avoided. This also applies where the fixed part of the hinge may be cast as a portion of the mouthpiece. The shape of the cross-bar G and adjustments may vary somewhat from those shown in the drawing: (1) By making the cross-bars of the faced lids of the retort mouthpieces (and other similar lids) flexible, in such a manner as to make the joint perfectly tight, and at the same time be able to easily rub the faced surfaces together. (2) By an adjustment of the hinged ends of the cross-bars.

The method of working the retort lid and fastening is by the hinges, cross-bar, and other parts, having been fitted up as shown. The lid is swung with the cross-bar till the faces meet. The catch F is then closed, to secure the free end of the cross-bar. The eccentric action of the hand-lever H being brought into play, presses the lid against the face of the mouthpiece; and the eccentric action being continued, the faces are rubbed together by pressure of the flexible cross-bar G.

APPLICATIONS FOR LETTERS PATENT.

10,227.—Collins, C. R., "Carburettors." May 23.

10,284.—Richmond and Co., Ltd., and Richmond, E. W. T., "Gas-irons." May 24.

10,310.—Hartley, J. W., and Kerr, J., "Gas and like engines." May 24.

10,312.—Halley, W. S., and Best, J., "Gas-stoves and ranges." May 25.

10,313.—Miller, H. P., "Portable gas heating apparatus for light cooking." May 25.

10,389.—Evers-Swindell, H., "Gas-retorts." May 26.

10,439.—M'Mullen, J. A., "Gas-engines." May 27.

10,454.—Beaux, P. W. de, "Regulating device for incandescent gas-lamps." May 27.

10,478.—Davy, W. J., and Davenport, T. W., "Air or other gas pumps." May 29.

10,519.—Hartig, I., "Lighting and extinguishing a series of gas-lamps, suitable for railway carriages." May 29.

10,554.—Manchester Oxygen (Brin's Patent) Company, Ltd., and Jackson, W. M., "Utilizing the pressure in cylinders or reservoirs of compressed gases in the employment of such gases." May 30.

10,616.—Schlesinger, R., "Igniting devices for gaslight." May 30.

10,638.—Sangster, J., "Gas lighting, extinguishing, and controlling apparatus." May 30.

10,695.—Dubois, J. L., "Cocks for water, gas, steam, or other fluids." May 31.

10,698.—Wainewright, R. S., "Collecting the fumes from gas-burners." May 31.

10,801.—Peebles, D. B., "Gas or vapour motors." June 2.

10,981.—Kent, W. G., "Disc engines, particularly suitable as water-meters." June 5.

10,982.—Seddon, H. C., "Chimneys or outer cases of regenerative lamps." June 5.

10,996.—Johnson, J. Y., "New colouring matters or dyes from naphthalene." A communication from the Badische Anilin and Soda Fabrik. June 5.

11,015.—Spicer, E. and H., "Manufacture of gas for illuminating and heating purposes." June 6.

11,138.—Jarvis, G. A., "Gas-engines." June 7.

11,185.—Price, W. E., "Gas-meters." June 7.

11,286.—Hilliger, G., "Furnace adapted for the combustion of coal-dust." June 8.

11,289.—Curle, W., "Water-meters." June 8.

11,407.—Lanchester, F. W., "Gas and oil motor engines." June 10.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by our correspondents.]

Cooking by Electricity.

SIR,—I most certainly did not intend to be "down on" the promoters of cooking by electricity, but simply to attempt to put the question on a satisfactory basis for comparison with gas. Having no reliable data at hand, I took Mr. Dowsing's figures, which proved to be greatly overstated as regards the available duty. Personally, I am greatly in favour of cooking by electricity, as there can be little doubt that it is simply an introduction to gaseous fuel. Those who employ electricity for cooking will be charmed by the cleanliness and ease with which it can be done on a very small scale. But when they wish to enlarge their operations, the enormous cost of electricity for heat, under the best possible conditions, will bar the way; and, its users being accustomed to cleanliness and ease, it is only natural that gas will be finally adopted. Having been connected with the manufacture of electrical cooking apparatus almost from the first attempts made, I have some little knowledge of its capabilities; and I see no reason why its use should not be encouraged in a fair and open way, so long as its enormous cost is known and acknowledged. Once get consumers accustomed to cleanliness and neatness in cooking, and the way is open at once for gas, which will do the same work as electricity, and do it as least as well, at one-twentieth of the cost, or probably even less. Under the circumstances, the extended use of electricity for cooking and heating can only have one result—the more general use of gas for the same purpose. I am by no means in favour of cheapness and inferior results; but when our own cooking is done by gas, in the most perfect manner, at a cost of £10 per annum, I should not care to do the same work, equally well, at a cost of £200 or £300 per annum for electricity, although, if it were available, I should probably use it on a small scale for special purposes, and thereby reduce my gas bill probably a shilling or two per annum.

Warrington, June 15, 1893. THOS. FLETCHER.

The New Method of Charging for Consumption of Gas.

SIR,—The new method of charging for gas consumed, as reiterated and condemned by your correspondent Mr. W. Livesey in the JOURNAL for the 6th inst., is so absurd as to be hardly worthy of notice; and nearly equally bad is the gradation of discounts up to 25 per cent., as reported to be in operation at Taunton. In fact, all discounts on gas consumed are erroneous, as being *in effect* an allowance in the price. Circumstances alter cases, and places vary prices; but there is no reason why a right principle should not be adhered to for all monopoly undertakings. In reference to gas monopoly, your correspondent wrote very rightly as follows: "Now, however, that each company has a separate price, is limited to a certain district, and is to some extent protected in that district, it ought to be clearly understood that every consumer in the district living within a certain distance of the company's mains *can demand* a supply of gas on the same terms as his neighbour."

A uniform price over a fixed area of supply should be the policy of gas companies; and as regards discounts, these should not be entertained—not even to oblige a single customer. A gas company may demand a cash deposit before giving a supply; and I think that, if gas companies established this principle, they would displease consumers less than they do by cutting off the supply because an account is not paid up *in full* on or before a date fixed by themselves. Companies are not compelled to give credit; and they should not be against receiving payments on account after a debt is incurred. A debt need not be increased beyond a fixed amount.

Varying prices for different makes of gas for light and heat—where there is a separate source of supply—is a matter for business arrangement; but while there is one supply from one source, there should be one price to one and all. There is no analogy between wholesale orders for either manufactured goods or produce and large gas cousumers.

A relative percentage of profit to the selling price of shares has no connection with dividend on share capital. Therefore directors might reasonably try to improve the lot of their staff of working-men by a "bonus" out of surplus profits; and then try a reduction in the price of gas, instead of squeezing to pay dividends above 10 per cent. on the share capital.

London, June 15, 1893. FIO.

"Hawkite Gas."

SIR,—I notice two errors in my letter on the above subject which appeared in yesterday's JOURNAL—viz., the atomic weight given for $Fe\,SO_4$, $7OH_2$ (p. 1101) is 258. This should be 278. The number of units of heat in a cubic foot of coal gas is given as "about 6000." This should be "about 600." These are obviously typographical errors, as shown by the sequence; the working being quite correct. I also wish to point out that, since about 50 per cent. more "Hawkite" gas is required than coal gas, volume for volume, in order to give the same power, the cost of production of the former gas requires to be modified in this proportion—viz., about 14s., instead o fgs. 3d., per 1000 cubic feet—when the value of the sulphate of iron crystals is realized; and about 31s. 6d., instead of 20s. 11¼d., per 1000 cubic feet when the sulphate of iron crystals are wasted. These modifications, of course, are necessary for comparison with coal gas.

The increased consumption of "Hawkite" gas is evident on referring to the engine test given in my previous letter; but I have also observed it in connection with the burning of the gas with a Welsbach incandescent mantle and burner. There were two of these burners, similar in every respect—one burning coal gas, and the other "Hawkite" gas. When both were of about the same intensity in illuminating power, the consumption of coal gas varied from 2 to 2½ cubic feet per hour; whereas that of the "Hawkite" gas ranged from 3¾ to 4 cubic feet per hour. I have even noticed it as much as 4½ to 5 cubic feet per hour.

There is no doubt that hydrogen—or "Hawkite"—gas is very inferior to coal gas, volume for volume, when used in the cylinder of a gas-engine; for the former being a simple gas ignites so quickly as to occasion shock. The strongest mixture of hydrogen gas—viz., 2 volumes of the gas to 5 volumes of air—has an explosion-time of 1-100th of a second; whereas with coal gas the most rapid—viz., 1 volume of gas to 6 volumes of air—has an explosion-time of 4-100ths of a second. It is not a high initial pressure, which is not sustained throughout the stroke, that is wanted, but a more uniform and equally distributed pressure, such as is obtainable with coal gas. The "Hawkite" Company claim that their process is suitable for isolated places, where coal or "Dowson" gas is not obtainable. But it may be pointed out that the various forms of oil and gasoline motors also possess this feature, with the advantage that there is no bye-product to be disposed of as in the "Hawkite" process, which must be transported from the isolated position to a suitable market in order to reduce the price of the gas to the exorbitant sum of 14s. per 1000 cubic feet as compared with coal gas; and it is probable it would be much more than this by the time carriage, &c., had been paid for. Another advantage of the oil motors is that only the oil is necessary to be transported; whereas in the case of "Hawkite" gas, the iron or steel blocks and sulphuric acid (the carriage of the latter being in many cases very objectionable), as well as the oil when the gas was carburetted, would have to be transported. The small space taken by the vaporizers on an oil or gasoline engine would also constitute another advantage over the comparative bulk and weight of a "Hawkite" generator. The cost of "Hawkite" gas to produce power would be about 4d. per brake horse power per hour, when the value of the sulphite of iron crystals was realized, and about 8d. per brake horse power per hour when the crystals were wasted.

June 18, 1893. EDWARD J. M. DAVIES.

Fatal Accident at the Tettenhall Water-Works.—Last Saturday week, an engine-cleaner, named Joseph Ashper, met with a shocking death at the Tettenhall Corporation Water-Works pumping-station. The deceased was following his occupation, when, for some unexplained reason, he put his head inside the railings surrounding the machinery; and it was struck by a descending plunger—the injuries being of such a character that death was almost instantaneous. The deceased was 55 years of age.

The Results of the Gas Agitation at Swinton.—At the meeting of the Swinton and Pendlebury Local Board, yesterday week, an estimate of the expenditure for the ensuing year was submitted. Mr. Keirby moved that a general district rate of 3s. in the pound, as against 2s. 2d. last year, be levied for the coming year. He explained that, of the extra 10d., 9d. was required to pay the costs incurred in the unsuccessful attempt to obtain an Act to authorize them to supply gas in the district. Mr. Gerrard remarked that the agitation during the past five years had resulted in a saving to the district of £7000 in the price of gas. The motion was carried.

Burnley Corporation Water Supply.—An interesting announcement has just been made at Burnley as to the recently constructed water-works at Cant Clough. The works, which have passed through a good many vicissitudes, were commenced about eight years ago, at an estimated cost of £70,000. The actual total cost has been, according to the statement of the Chairman, £153,640—an amount slightly more than twice the estimate. The reservoir has an area of 38 acres, a depth of 60 feet, and a holding capacity of 250 million gallons, bringing up the total capacity in the five reservoirs to 440 million gallons. The most remarkable thing about the new reservoir is its puddle trench, which is reckoned to be the deepest in the world; and it was in trying to find a satisfactory bottom that the actual cost has so far exceeded the estimate.

The Water Supply of Pontypridd and Ystradyfodwg.—A deputation recently waited upon the Water Committee of the Glamorgan County Council to ask them to appoint a Sub-Committee to wait upon the President of the Local Government Board to bring before him the desirability of the repeal of clause 52 of the Public Health Act, which prevents local authorities supplying water unless existing companies are neither able nor willing to afford an adequate service; and the repeal of the section of the County Councils Act, which prevents county councils promoting Water Bills. It was pointed out that the larger the quantity of coal which was worked, the more limited became the source of water supply in the Rhondda, owing to fissures and diversions; while, with an ever-increasing population, the demand became greater. They impressed upon the Committee the imperative importance of this water question to Pontypridd and Main Rhondda, with their population of nearly 130,000, and the desirability of the County Council doing all in their power to assist the Local Authorities in the matter. The Committee privately discussed the subject; but it is understood that they resolved to send a deputation to the Local Government Board.

Gas Affairs at Stratford-on-Avon.—Two or three interesting matters connected with the gas undertaking came before the Stratford-on-Avon Town Council last Tuesday. The first had reference to the management. From a statement made by the Town Clerk, it appeared that a petition had been sent to the Council in which the opinion was expressed that a change should be made in the management of the department. The Town Clerk had written to ten of the persons signing the petition, asking them to state "the facts within their knowledge" which they considered rendered such a change desirable. Only one reply had been received, and that revealed nothing beyond what was already known. The Gas Committee, having made inquiries as to the duties of managers of different corporation gas-works, saw nothing in them to alter their arrangements with their Manager (Mr. J. S. Cranmer); but they directed that in future he should not undertake other work without their sanction. The Committee, in their minutes, recommended that, on and after the 1st prox., the price of gas be reduced to 3s. 6d., 3s. 4d., and 3s. 2d. per 1000 cubic feet, instead of 3s. 10d., 3s. 7d., and 3s. 4d. This was adopted. The Auditor (Mr. F. L. Thompson) presented a report, which showed that the profit on the gas undertaking for the past year was £1498, as against £1723 in the preceding twelve months.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bill read the first time, and referred to the Examiners: Leeds Corporation (Consolidation and Improvement) Bill.

Bills read a second time and committed: Barnoldswick Local Board Bill; Electric Lighting Provisional Orders Bill (No. 4); Leeds Corporation (Consolidation and Improvement) Bill; Water Provisional Orders Bill (No. 1).

Bills reported: Electric Lighting Provisional Orders Bills (Nos. 4 and 6).

Bills read the third time and passed: Barry and Cadoxton Local Board Bill; Belfast Water Bill; Blackpool Improvement Bill; Electric Lighting Provisional Orders Bills (Nos. 5 and 6); South Staffordshire Water Bill.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read the first time, and referred to the Examiners: Belfast Water Bill; Electric Lighting Provisional Orders Bills (Nos. 5 and 6).

Bills read a second time and committed: Bilston Commissioners (Water) Bill; Electric Lighting Provisional Order Bill (No. 7); Pontypridd Local Board Gas Bill.

Bill reported: Greenock Corporation Bill.

Bill read the third time and passed: Todmorden Local Board Gas Purchase Bill.

In respect to the Water Provisional Orders Bill (No. 2), it was ordered, on the motion of Mr. Edwards, that power should be given to the Committee on the Bill to insert in the Llandrindod Wells Water Order a clause empowering the Landrindod Wells Local Board of Health to purchase the rights, powers, privileges, works, and property of the Llandrindod Wells Water Company, at a price to be agreed upon by the parties, or, in case of dispute, to be settled by arbitration.

HOUSE OF LORDS COMMITTEE.

(*Before the Duke of* RICHMOND AND GORDON, *the Earl of* MAR AND KELLIE, *Earl* MAYO, *Lord* CARYSFORT, *and Lord* HERRIES.)

LONDON COUNTY COUNCIL (GENERAL POWERS) BILL.

This Bill—which includes powers of representation on the Thames Conservancy, additional representation on the Lea Conservancy, and the expenditure of £10,000 upon inquiries relating to water supply and other questions—came before the above-named Committee on Monday last week. The matters in which our readers are specially interested were fully reported when the Bill was before a Committee of the Lower House (see *ante*, p. 785); and therefore it is unnecessary to go into them again at any length.

Mr. FREEMAN and Mr. F. W. PEMBER appeared for the promoters of the Bill. It was opposed by the Conservators of the River Thames; the Lea Conservancy Board; the Southwark and Vauxhall, East London, and Grand Junction Water Companies; the Essex, Berkshire, Middlesex, and Surrey County Councils; the Corporation of London; the riparian owners on the Thames; the West Ham Corporation; and other local authorities. The various opponents were represented by Mr. LITTLER, Q.C., Mr. PEMBER, Q.C., Mr. BALFOUR BROWNE, Q.C., Mr. WORSLEY TAYLOR, Q.C., Mr. CRIPPS, Q.C., Mr. PEMBROKE STEPHENS, Q.C., Mr. H. C. RICHARDS, Mr. RUSSELL GRIFFITHS, Mr. CLAUDE BAGGALLAY, and Mr. C. B. GEDGE.

The Committee dealt first with the part of the Bill relating to the Thames Conservancy.

Mr. FREEMAN, in opening the case for the promoters, explained that the Bill proposed to give the Council four representatives upon that body; thereby increasing the number of members from 23 to 27, although in the Bill as it came before the Commons Committee it was proposed that there should be an addition of seven members representing the County Council. He laid before the Committee at some length the grounds upon which he asked for the representation of the Council on the Conservancy Board; and he then called evidence in support of his proposal.

Mr. *A. R. Binnie*, Chief Engineer to the County Council, was the first witness; and his examination extended over the remainder of the day, and part of the next. He was cross-examined as to whether it was not the object of the Council, in getting representation, to do away with agreements which had been made between the Conservators and the Water Companies, and which he considered to be *ultra vires*. He admitted that they would use all their influence to get rid of them, and that there must be antagonism of interest where a possible future purchaser and seller were concerned.

Mr. *W. H. Dickinson*, the Deputy-Chairman of the Council, was also examined, and spoke as to the steps which had been taken by that body, and the proceedings of the Council in relation to the question; maintaining that, in the interests of the purity of the water supply and of the river, the Council were entitled to be represented on the Conservancy Board, though he did not allege that the Conservancy had failed in their duty. If the Council had been represented at the time, he did not think the agreements to allow the Water Companies to draw so much water from the river would have been permitted.

Mr. *W. J. Dibdin*, F.I.C., F.C.S., the Chemist to the Council, was called to speak as to pollutions of the Thames; when,

Mr. LITTLER asked whether the Committee were going to inquire into the present condition of the river.

The CHAIRMAN said it had not been denied that there were certain impurities; but the inquiry would be endless if they were to go into chemical evidence.

Mr. LITTLER did not think it would be possible to say, with regard to any river in England, that all the vigilance of the authorities had detected every impurity.

The case for the promoters was then closed.

The Committee were next addressed against the Bill by Mr. LITTLER, for the Thames Conservators and the City Corporation; by Sir GILBERT EAST, on behalf of the riparian owners; by Mr. CLAUDE BAGGALLAY, for the Corporation of West Ham; by Mr. RICHARDS, for the Essex County Council; and by Mr. PEMBROKE STEPHENS, for the Surrey County Council.

At the close of the speeches, the Committee consulted in private for a short time. On the re-admission of the public,

The CHAIRMAN said: The Committee have decided that so much of the preamble as relates to the representation of the London County Council on the Thames Conservancy is not proved. Of course, the Bill will have to be amended in accordance with the decision come to upon the preamble.

The case of the Council's representation upon the Lea Conservancy Board was then entered upon; and at the close of Mr. FREEMAN'S opening, the Committee adjourned.

On Wednesday, Mr. *T. H. W. Idris*, the present representative of the Council on the Board, was examined as to the difficulties of dealing with the effluents into the Lea, and the steps taken by the Conservancy, and himself in particular, to cope with them.

Mr. *W. Pearce*, a chemical manufacturer and barge-owner at Limehouse, and a member of the Council, said the neighbourhood had suffered so much from the lowness of the water and its impure character, that he was desirous that the municipal and trade interests upon the Conservancy should be strengthened; these being at present overbalanced by those of the owners of land. He believed that the neglect of the river arose from the want of money; but he admitted that there was no proposal in the Bill to give the Conservancy additional funds. He did not think the Conservancy had done their best with their present means.

Mr. *A. R. Binnie* was also examined, and was proceeding to refer to the works which the Council were about to carry out for the diversion of the storm overflow, when

The CHAIRMAN suggested that this did not bear upon the question into which the Committee were inquiring—viz., that there should be three County Council members, instead of one, upon the Board.

Mr. FREEMAN said it was in order to meet the suggestion, made in cross-examination, that the County Council contributed to the pollution of the river. He was very anxious to show, through Mr. Binnie, that what they were doing at present was causing hardly any pollution, but that they were taking every step to remove even that.

The CHAIRMAN: Do you think that it bears very much on this question?

Mr. FREEMAN: Perhaps not very much.

Mr. *W. J. Dibdin* was about to be examined, when

Mr. PEMBER interposed, and said that, if the Committee were going to try the composition of the Lea water, he was afraid the inquiry would be a long one. Besides, the Water Commission—a tribunal constituted for the purpose—had already gone into the question.

The CHAIRMAN said the evidence could be given very shortly.

Mr. *Dibdin* then gave evidence with regard to the quality of various samples of effluents taken from the Lea, which, he said, were much worse than ordinary sewage.

This being the whole of the evidence called by the promoters,

Mr. PEMBER said he did not see that the opponents had any case to answer.

The COMMITTEE consulted for a short time in private. On the re-admission of the parties,

The CHAIRMAN said the Committee had decided that so much of the preamble as related to the representation of the Council on the Lea Conservancy Board was not proved.

Mr. FREEMAN then opened the case in respect to clause 15 of the Bill, which proposed to authorize the Council to expend £10,000 on inquiries and negotiations, and objected to the *locus standi* of the Corporation and of the Water Companies against the clause.

Mr. LITTLER supported the *locus standi* of the Corporation.

Mr. FREEMAN interposed; stating that, as he understood the Companies did not appear against the clause, he would withdraw his opposition to the *locus standi* of the Corporation.

The CHAIRMAN: I think you have exercised a wise discretion.

Mr. *W. H. Dickinson* was the only witness examined in support of the proposal.

After a short consultation in private,

The CHAIRMAN said the Committee had decided that the part of the preamble which related to clause 15 had not been proved.

The Committee have therefore reversed the decision of the House of Commons on all three points.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir R.* TEMPLE, *Chairman; Mr.* LYELL, *Mr.* MYERS, *Mr. G. R.* BENSON, *and Mr.* BONHAM-CARTER, *Referee.*)

Wednesday, March 22.

DEVONPORT WATER BILL.

The cases for the Stonehouse and Plymouth Water Bills having been completed, as already reported (*ante*, pp. 952, 1006, 1048), the above-named Bill came under consideration.

Mr. LITTLER, Q.C., Mr. PEMBROKE STEPHENS, Q.C., and Mr. FREEMAN appeared for the promoters, the Devonport Water Company; Mr. CRIPPS, Q.C., represented Sir Massey Lopes; and Mr. PEMBER, Q.C., Mr. BIDDER, Q.C., and Mr. YOUNG were retained for the Stonehouse Local Board, in opposition to the Bill.

Mr. PEMBER, at the opening of the sitting, mentioned that, having reviewed the whole circumstances of the three Bills, the Stonehouse Local Board had come to the conclusion not to offer any opposition to the Bill of the Devonport Water Company. As far as they could see, the only provision which really affected Stonehouse was the clause which provided for the handing over to the Board of the undertaking of the Company within their limits; and this was quite consistent with the Stonehouse Bill, which the Board hoped to get.

Mr. LITTLER explained that the Devonport Water Company was

incorporated in 1793 by an Act of Parliament, which authorized them to supply Devonport, Stonehouse, the parish of Stoke Damerel, and adjacent parts. The phrase "adjacent parts" was the customary one used in those days; and it had been the lot of more than one Committee to discuss its meaning. The usual interpretation was such moderate extension and territory as was reasonable under the circumstances of each case. Plymouth had some objection to the boundaries of the Company's limits; but he did not fancy it was a very strong objection, because the Corporation had elected not to oppose the Bill. The Company, on the other hand, recognized that the non-appearance of Plymouth against their Bill was not to prejudice the Council hereafter in anything they might have to say on the subject. In 1876, the Company obtained another Act of Parliament, under which their capital charges and dividend were fixed; and they were placed under an obligation to provide a constant supply of water, construct filter-beds, and filter all the water supplied for domestic purposes. In 1889, further powers were obtained for the enlargement of the existing, and the construction of new works. The Company supplied the whole of Stoke Damerel, which included the municipal borough of Devonport and all the Government establishments in that town. Under a curious old Act of Elizabeth, the Local Board of Stonehouse claimed that they had certain parliamentary powers of water supply. Undoubtedly they had the power to levy a water-rate. Under these powers, the Local Board put a water-rate on all properties, whether or not they took the Stonehouse supply; but the rate was limited to 20s. If a house was worth more than £20 a year, they could only levy on it a water-rate of 20s per annum; but under their present Bill, the Local Board were seeking to remove this limitation. By some arrangement which they could not quite trace, Plymouth had obtained powers to serve Stonehouse. Consequently, there were now three different authorities who could supply East Stonehouse with water. Plymouth up to the present time had been short of water, and had not given a satisfactory supply. Stonehouse itself had very little; and they could not give one. The best proof of this fact was that a large number of people in Stonehouse did not take the Stonehouse water, although they paid the Local Board water-rate, but were supplied by the Company. Such a state of things ought not to continue. For this reason, a long series of negotiations had taken place with the Local Board representatives, in the course of which the Company offered to supply to the Board any quantity of water in bulk at a rate slightly under 3¼d. per 1000 gallons; and, as the result of negotiations, a clause had been inserted in the Stonehouse Bill giving the Board the right to purchase the property of the Company in Stonehouse.

The CHAIRMAN called Mr. Pember's attention to the statement in the preamble of the Bill, declaring that it was expedient, and would be to the advantage of the Stonehouse district, that the Local Board should obtain any additional supply of water they might require from the Company, instead of by means of the new water-works, for the construction of which they were seeking powers from Parliament. He asked whether the Board acquiesced in this statement.

Mr. PEMBER confessed that he had not read the paragraph in the preamble. He, of course, dissented.

The CHAIRMAN (to Mr. Littler): What are the powers you seek under this Bill?

Mr. LITTLER explained that the Company sought, in the first place, to extend their limits, and to have the power to lay down pipes for the serving of the new district. They also wanted the power to supply Stonehouse in bulk, and to sell to the Local Board their pipes and property in Stonehouse. Next, they had some trouble with Sir Massey Lopes. At Lowry Hatch, the Company rented a cottage from Sir Massey Lopes; and it was occupied by one of their men. He had threatened to deprive them of this cottage; but as it was absolutely necessary to them, they asked power to purchase it compulsorily.

Mr. *F. J. Bone*, the Secretary of the Company, described the extent and character of their works. He said they had an abundant service of water for the whole district; and, during the drought of 1883, they gratuitously supplied the whole of Stonehouse from stand-pipes in the streets. Practically, Stonehouse was dependent on the Devonport mains for water for the extinction of fire. At present the Company supplied about double the quantity of water provided by Plymouth. The total supplied by the Company in Devonport and Stonehouse was 1,750,000 gallons daily; and they were willing to furnish all that Stonehouse required.

Mr. BIDDER, at this stage, said he was in a position to make a communication which would materially lighten the labour of the Committee. Stonehouse had no desire to contract independent water-works if they could obtain a supply for the district as cheaply as they could get it for themselves; and Plymouth, on the other hand, had no wish to make a profit out of Stonehouse. Under these circumstances, terms of agreement had been arrived at between the two Authorities, subject to the approval of the Committee. Under the agreement, the Stonehouse Bill would be allowed to pass, so far as the rating powers it conferred were concerned, but the reservoir and other works were to be abandoned; Plymouth undertaking to give a continuous supply of water in bulk to Stonehouse at all times from the Hartley reservoir. The supply would be to the requirements of Stonehouse up to 1,000,000 gallons per week during the first two years; 1,750,000 gallons per week in the next three years; and afterwards on the assumption that the Burrator reservoir was completed, 500,000 gallons per diem. The rate to be charged was 2½d. per 1000 gallons for the first 60 years, and afterwards 1d. per 1000 gallons. He hoped that this arrangement would meet with the approval of the Committee, and that they would pass the Stonehouse Bill in the modified form which the agreement contemplated.

Mr. POPE, on behalf of the Plymouth Corporation, intimated his entire concurrence.

Subsequently Mr. BIDDER said the provisional agreement had been prepared and signed by Mr. Ellis on behalf of the Plymouth Corporation, and by Mr. R. Robinson Rodd, jun., for the Stonehouse Local Board. Its terms were: (1) The Stonehouse Bill to pass as to the rating powers, and the works powers to be abandoned. (2) Plymouth to undertake to give, and Stonehouse to take, a continuous supply of water at all times from the Hartley reservoir, after the main to be provided by Stonehouse is laid, to the amount of their requirements up to 1,000,000 gallons per week for the first two years from date, 1,750,000 gallons per week for the next three years, and thereafter up to 500,000 gallons per diem. (3) Until the connection is made with the Hartley reservoir, the supply to be as at present. (4) The rate to be charged to be 2½d. per 1000 gallons for 60 years from the present date, and thereafter in perpetuity 1d. per 1000 gallons. (5) The present agreement to be cancelled from the date of this agreement. (6) The terms to be embodied in the form of an agreement, and to be settled, in case of dispute, by arbitration.

Mr. FREEMAN announced that an agreement had been made between the Company and Sir Massey Lopes, under which the latter withdrew his opposition.

Mr. *Bone's* examination was resumed. Replying to the Committee, he stated that Sir Massey Lopes enjoyed the advantages of the water from the Devonport leat on sufferance, and against the will of the Company.

Mr. *T. Hawksley* stated that he was well acquainted with the Devonport Water-Works. The capacity of the leat was between 5,000,000 and 6,000,000 gallons daily. At present the daily supply was 1,750,000 gallons, of which 300,000 gallons were delivered to the Government establishments, and the remainder served a population of 57,000; the supply being at the rate of 25 gallons per head per day. The water was exceedingly pure. The Company had sufficient water for the whole of Stonehouse.

Professor *Dewar* said he had analyzed a sample of the Devonport water, and found it of great purity and extraordinary softness.

Mr. FREEMAN explained, with reference to clause 12 of the Bill, which proposed to extend the limits of the Company to Pennycross and St. Budeaux, that an arrangement had been made under which the Company would supply the former and the Plymouth Corporation the whole of the latter place.

Mr. POPE added that St. Budeaux was now included in the Plymouth district; and the effect of the present arrangement would be to leave the Corporation undisturbed there, and give the Company the right of supplying Pennycross.

This closed the case for the Devonport Water Bill.

Mr. *Hawksley* was then recalled by the Committee to explain certain matters in connection with the Plymouth Bill. Asked whether it was a fact, as stated in evidence, that the Head Weir site, which was sanctioned by Parliament in 1887, and which had since been abandoned, was proposed on his recommendation, he replied that it was not—that he always suggested that the Burrator site should be adopted for the dam; but he was absolutely prohibited from reporting on that site by the Chairman of the then Water Committee. He represented to the Committee that the site was the right one from an engineering point of view. After the Bill of 1887 had passed, he was so suspicious of the unsoundness of the Head Weir site, that he declined to sanction the works until explorations had been made. These explorations resulted in the discovery that the site was in the middle of an ancient lake, which had been filled up with Dartmoor granite *débris*, and was totally unfit for a reservoir dam.

The CHAIRMAN: When the Parliamentary Committee of 1887 sanctioned that site, plans must have been deposited.

Witness: Plans were deposited in 1886—I made them; but nothing was known.

Were no inquiries made in 1887 as to the engineering soundness of those plans?—No; because it was too late.

Mr. POPE: It was an unopposed Bill; and there was no inquiry as in this case.

The CHAIRMAN: I am very pleased, Mr. Hawksley, we have had the opportunity of asking you these questions, because the Committee had gathered—erroneously, I am glad to say—that the scheme of 1887 was submitted with your approval. Now I understand you never did approve of it.

Witness: I was directed by the then Water Committee to adopt that site. It was not known at the time what was the nature of the underground strata. I had been to the spot many times; but I could not see underground, and they did not make any explorations.—in fact, they delayed the application to Parliament until it was too late to make explorations.

The CHAIRMAN: It is rather a revelation to us of the way in which Bills are sometimes passed through Parliament that a scheme so faulty, and so unworthy, should be sanctioned.

Mr. POPE endorsed the observations of the Chairman; adding that many an unworthy Bill was slipped through Parliament when it was unopposed, because Committees did not satisfy themselves as to its merits.

The CHAIRMAN asked if there was any chance of the Plymouth Corporation coming to terms with Lord Morley with regard to the quantity of compensation water to be discharged into the river.

Mr. CRIPPS said he thought, if the Corporation desired to settle the matter, they might be able to arrange a clause satisfactorily.

After a brief consultation in private,

The CHAIRMAN announced that the Committee had passed the preamble of the Stonehouse Bill, with the exception of the paragraph authorizing the construction of additional works; and that the preamble of the Plymouth Bill was approved without any alteration. The preamble of the Devonport Bill was also approved, except the paragraph which declared it would be to the advantage of the Stonehouse district that the Local Board should obtain an additional supply of water from the Devonport Company.

The Committee then adjourned till the following Friday, when the Stonehouse and Devonport Bills were disposed of. A further adjournment till the next Monday was agreed upon in regard to the Plymouth Bill, to allow of the settlement of a difference between Sir Massey Lopes and the Plymouth Corporation. After some delay, the Committee considered all the clauses, and passed the Bill.

Halifax Corporation Gas Accounts.—The Gas Committee of the Halifax Corporation have completed their accounts for the year ended March 31 last. A profit of £2800 had been estimated; but, as a matter of fact, it is £3600. This is very satisfactory, considering the difficulties that have had to be contended with.

LEGAL INTELLIGENCE.

MANSION HOUSE POLICE COURT.—Thursday, May 15.

(*Before Alderman* J. V. MOORE.)

The Water-Gas Apparatus at Beckton and Deficiencies in Illuminating Power.

To-day, The Gaslight and Coke Company were summoned at the instance of the Corporation of London for having, on Dec. 19 and 20 last, unlawfully supplied gas of deficient illuminating power to the Kinghorn Street and Dorset Buildings testing-places.

Mr. CRAWFORD, the City Solicitor, appeared for the Corporation; Mr. ROBINSON (of Messrs. Bedford, Monier-Williams, and Robinson) for the defendants.

Mr. ROBINSON pleaded guilty.

Mr. CRAWFORD said that the fact of the Company having pleaded guilty was really sufficient for this case; but perhaps he ought to make a brief explanation. Certain examiners were appointed by the Corporation with a view of making daily tests of the illuminating power and purity of the gas supplied in the City; and copies of their reports were forwarded to the Company and to the Chief Gas Examiner (Dr. A. W. Williamson). The Company might from time to time, if they thought fit, appeal to the Chief Gas Examiner; and, in this particular case, they did avail themselves of this privilege. He thought it was important that he should read Dr. Williamson's report, because it would be seen that practically the cause of the low illuminating power arose from the use of a new method of producing gas. The report was as follows:—

In the matter of the appeals of THE GASLIGHT AND COKE COMPANY *against the reports from the Kinghorn Street testing-place, showing deficient illuminating power in the gas delivered by the Company on the 19th and 20th of December, 1892. Also from the Dorset Buildings testing-place, showing deficient illuminating power on those same days.*

Each of the appeals was lodged within seven days after the day on which the respective report was delivered. At the hearing which I gave to the parties in these appeals, Mr. Trewby appeared for the Company; Professor Lewes, for the Corporation.

It was stated that, at the time of these tests, the gas supplied to the Kinghorn Street and Dorset Buildings testing-places was made at the Beckton works by the aid of a new process of carburetting the coal gas. The carburetting apparatus was described as consisting first of all of a generator, in which the water gas is made. The next thing is the carburettor, in which the oil is put; and then there is the superheater. The carburettor and superheater contain fire-bricks, built up with intervals between them like the bricks in a regenerator. The apparatus is prepared for use by blowing air through hot coals in the generator; the carburettor and superheater being raised to a dull red heat by the products of combustion from the generator. The blast of air is then shut off, and steam is blown in through the hot coals in the generator, forming water gas. Oil is at the same time poured into the carburettor. There are small sight-holes closed by glass in various parts of the apparatus, to enable the manager to judge of the intensity of the heat.

For several days before the 19th of December, the apparatus was observed to be out of order—a large quantity of carbon being deposited in the carburettors and superheaters; while the oil introduced into the apparatus was really being thrown away. To set matters right, the accumulation of carbon was burnt out of a number of carburettors and superheaters by a stream of air. When the apparatus was used after this treatment, it was found to be so intensely hot that the oil introduced into it was converted into solid carbon, without any appreciable formation of illuminating gas. It was frankly stated by the able manager of the works that this result was due to an error of judgment, and would not occur again.

It is clear that the deficient illuminating power of the gas as reported arose from the irregular working of an apparatus of which the Company had not any lengthened experience. I consider that the reports must be accepted.

(Signed) ALEX. W. WILLIAMSON,
Chief Gas Examiner.

May 27, 1893.

Continuing, Mr. Crawford pointed out that this report was conclusive, and that his Worship was bound by it. As to the amount of the deficiency, on Dec. 19 the gas was reported to be of 15·3-candle power, instead of 16 candles; and on the following day, 15·25 candles. As to the penalty, section 14 of the Company's Act of 1880 provided that, for the first half candle of defective illuminating power, there should be a fine of 40s. It would be observed that the deficiency in this case was above ½ candle; but he did not ask for more than the nominal penalty of 40s. The relations of the Company and the Corporation were of a friendly character; and he should not ask for costs.

Mr. ROBINSON only wished to add that there had been an error of judgment in working the apparatus. This was the first time they had had any trouble in this respect; and it had not occurred since.

His WORSHIP said he should merely inflict a fine of 40s. in each case, without costs.

The Price of Gas in the Chartered Company's District.—A few weeks ago, a meeting of gas consumers was held in St. Luke's, with the object of taking some steps to bring about a reduction in the price of gas in the district of The Gaslight and Coke Company. A resolution was passed urging the Company to reduce their charge, and calling upon the County Council to take up the question, so that a uniform price may be charged for the whole of London. A similar meeting was held last Thursday, at the Board Schools, Buckingham Street, Caledonian Road, under the auspices of the West Islington branch of the London Reform Union. Mr. F. Ward presided. Mr. T. Lough, M.P. for the division, and Mr. Rowlands, M.P., having spoken in opposition to the policy of the Company, the following resolution was unanimously adopted: "That this meeting of gas consumers in public assembly strongly protests against the high price of gas charged by The Gaslight and Coke Company; and, bearing in mind that the price charged by the South Metropolitan Gas Company is only 2s. 5d. per 1000 feet, as against 3s. 1d. in the North of London, presses The Gaslight and Coke Company to give its earnest and immediate attention to the question of a reduction in price."

MISCELLANEOUS NEWS.

EDINBURGH AND LEITH GAS SUPPLY.

The Accounts of the Gas Commission.

The accounts of the Edinburgh and Leith Gas Commission for the year ending the 15th of May have been made up and issued by Mr. John S. Gibb, the Treasurer. They show a total income of £260,310. Of this sum, £245,036 was derived from the sale of gas; £10,941 from tar and ammoniacal liquor; £3966 from coke, &c.; and £52 from waste lime. The total expenditure was £210,625; the principal items of which are: Coal, £112,808; purifying materials, oil, water, &c., £6487; salaries and wages at works, £35,911; repair and maintenance of works and plant, £9596; salaries in distribution department, £8111; repair and maintenance of pipes and attendance at gasholders, £8131; repair and maintenance of meters, £4228; management charges, £6508; feu duties, rates, and taxes, £11,194; law and parliamentary expenses, £193; pensions and allowances, £842; and discounts, abatements, and bad debts, £6612. The balance carried to profit and loss account is £49,684. From this sum there has to be provided: Annuities, £34,000; interest on mortgages, £4624; to sinking fund for repayment of borrowed money, £1347; to sinking fund for redemption of annuities, £7224—making together £47,196, and leaving a net surplus of £2488. Last year a sum of £27,180 was carried forward; and the Commissioners have thus at their disposal a sum of £29,668. At present the sinking fund for repayment stands at £4629; and the sinking fund for redemption at £38,656. The reserve fund amounts to £2743. The stock capital account has been reduced from £350,000 to £347,941; the difference of £2059 being the nominal value of £200 of annuities which the Commissioners during the year purchased for £6015. In addition, the Commissioners have borrowed £134,698 on mortgage—the same sum as was returned last year. The capital expenditure of the Commissioners stands at £497,450, of which there was incurred during the year £6500 in the purchase of ground adjoining the Leith works, £3841 upon main and service laying, £1907 upon meters, and £830 upon gas cooking and heating stoves. There is a debit balance of £12,751 upon this account. The gas-stove account shows the value of stoves, &c., on hand and on hire at £1998. The quantity of coal carbonized was 132,038 tons; and of gas sold, 1,232,288,500 cubic feet.

ROTHERHAM CORPORATION GAS SUPPLY.

The Chairman of the Gas Committee of the Rotherham Corporation (Mr. C. J. Stoddart) has lately addressed to the members of the Committee a statement in regard to the gas undertaking. He explains at the outset that, as there has been an entire change in the management of the gas-works during the past year, a few facts relating to the working of the department and the financial results derived therefrom may be of interest. He then goes on to say that the quantity of coal carbonized in the past year was 15,108 tons; of cannel, 1264 tons—total, 16,372 tons, as compared with 16,812 tons in 1891-2. The average cost in that year was 11s. 0·13d. per ton; last year it was 11s. 1·11d. per ton. These figures show a reduction of 440 tons in the quantity, and an advance of 0·98d. per ton in the average price. The net result was a saving of £176. The quantity of gas made per ton of coal carbonized was 10,067 cubic feet, as against 9606 cubic feet in the previous year; and notwithstanding the fact that there were actually 440 tons less coal consumed, the production of gas was 464,815,000 cubic feet, as against 161,306,000 cubic feet in 1891-2—a gain of 3,909,000 cubic feet on the make. Less gas was burned on the works to the extent of 158,000 cubic feet, and the gas unaccounted for was 1,238,000 cubic feet less; so that the total increase in the sale of gas was 4,705,000 cubic feet, resulting in a net gain of £739. There was a considerable fall in the price of tar and liquor last year; the selling price of tar being 19s. 3d. per ton, against 27s. 9½d. per ton—a loss of £404. Liquor was sold at 8s. 2½d. per ton, against 9s. 7½d. in 1891-2—a loss of £217. In consequence of a re-arrangement of the work, better supervision, &c., there was a saving in wages of £302; also less slack lime, &c., was used to the amount of about £160. There was a sum of £90 17s. 3d. charged in the accounts as paid to the late Consulting Engineer, but which had no connection with the working of the year. There was also a net increase of £83 in the rates. The following is a summary of the economies effected in 1892-3, as compared with 1891-2: Coal, £176; wages, £302; carting, slack, lime, &c., £160; additional gas made, £739; decreased cost of repairs, £81; do. in general expenses, £63—total, £1521. As, however, there was an uncontrollable rise in certain expenses to the amount of £1774, the increase in the gross profit last year, as compared with 1891-2, was £347. Mr. Stoddart explains that, had it not been for the fall in the residuals, and other exceptional charges, there would have been augmented profits to the extent of £1500. In other words, had no change been made in the management, the Committee would have had to face a loss to this amount. Most of the foregoing particulars were contained in a report presented to the Committee by the Gas Engineer and Manager (Mr. C. B. Newton), who stated that during the year considerable alterations and repairs had been effected to put the works in a more efficient state. A new exhauster of an improved type had been fixed, and was working satisfactorily; and the underground tar and liquor tank, and the centre-valves connecting the purifiers, had been repaired and thoroughly overhauled. These last three were renewals which should properly have been placed upon the previous year's accounts; and they, together with the late Engineer's charges, reduced this year's profit to the extent of £166.

Stockton and Middlesbrough Water Board.—Mr. G. N. Yourdi having resigned the position of Resident Engineer of the Hury Water-Works of the Stockton and Middlesbrough Water Board, the Finance Committee have recommended the appointment of Mr. F. W. Macaulay at a salary of £300 per annum.

DUKINFIELD LOCAL BOARD GAS-WORKS.

The Manager's Annual Report.

The report of Mr. Harrison Veevers, the Engineer and Manager of the Dukinfield Local Board Gas-Works, for the year ending March 25 last has been submitted to the Local Board and adopted. In the course of it, he says that a consideration of the accounts for the year shows that it is the most unsatisfactory one, as regards the revenue account, since the separation with Denton and Haughton. The adverse balance is £670—an amount equal to 3d. per 1000 cubic feet of gas sold. The year, he remarks, has been an exceptional one: A prolonged dispute in the cotton industry caused a diminished income from gas of £468; the price of tar has fallen from 35s. 3d. to 10s. per ton, giving a less income of £398; and sulphate of ammonia has decreased in value above 10 per cent., and attained the lowest price ever known, yielding £48 10s. 3d. less than the previous year—partly due, as in the case of tar also, to the smaller quantity of coal carbonized. Already the prices of residuals have advanced; and, with improved trade and increased use of gas for heating and power purposes, it may be hoped that the past year will prove to have been a very exceptional one. The cost of making gas and charges for annuities, interest and sinking fund, with income from gas and residuals, at per 1000 cubic feet of gas sold, are given in the following table:—

	1893.				1892.	
	s.	d.	s.	d.	s.	d.
Cost of making and distributing gas			2	6·30	2	5·76
Less tar	0	1·32			0	2·90
„ sulphate of ammonia	0	1·69			0	1·79
„ coke	0	3·68			0	3·78
„ meter-rents	0	0·02			0	0·02
			0	6·71	0	8·49
Net cost of making gas			1	11·59	1	9·27
Add annuities	0	6·48			0	6·13
„ interest on loans	0	4·20			0	3·87
„ sinking fund	0	1·83			0	1·60
	1	0·51			0	11·60
Less interest	0	0·09			0	0·08
			1	0·42	0	11·52
Actual cost of gas			3	0·01	2	8·79
Present average price of gas			2	9·05	2	9·02
Loss per 1000 cubic feet			0	2·96		
Profit per 1000 cubic feet					0	0·23

During the past eight years, there has been an expenditure of £2358 for renewals of building and plant, charged to profit and loss account. The sale of gas in the same period has been 419,627,400 cubic feet; thus showing a cost of 1·35d. per 1000 cubic feet for renewals, &c., not otherwise taken into account in the above and previous yearly calculations. During the last year, the make of gas amounted to 59,791,000 cubic feet; sold, 54,275,500 feet; and unaccounted for, 5,515,500 feet—being equal to 9·22 per cent., as against 8·70 per cent. in 1891-2. Mr. Veevers also reports that the new purifier-house, purifier, and oxygen apparatus have been completed, and are in successful operation. Further on, he suggests that the use of gas should be promoted by the introduction of prepayment meters; but this suggestion, we believe, is still under the consideration of the Committee. With regard to the revenue account, the balance is £2140, as compared with £2848 in 1891-2. The gas-rental amounted to £7475, as against £7943. As to the capital, the contributions amounted to £30,565; while there has been expended £30,247—leaving only £317 unspent.

CORPORATION GAS UNDERTAKINGS IN LANCASHIRE.

Decrease in Profits.

At the last Meeting of the Burnley Town Council, the Chairman of the Gas Committee (Mr. Alderman Collinge) explained the serious difference existing between the estimates in the Gas Department and the actual results, to which brief reference was made in the JOURNAL last week. He said that the income was based upon a probable increase of 5 per cent., which was a moderate computation; but, as the Council were aware, there had been a serious discrepancy owing to the stoppage in the cotton trade. This amount came to some £7000 less than the estimate; and they considered that half of this would have been profit. Comparing the past year with the year 1890, when they made a profit of £6498, he said the output of gas was about the same in the two periods. The expenditure in 1890 was £25,552, and last year it was £29,298; but coal had cost £7746 more. Purifying came to £274 more, and stoking to £548 more, by reason of increases in the wages. Other items were £917 more; and management was £525 more. The interest and sinking fund account was £10,366, as against £9196; so that it was now £1110 more. If coal had remained at the same figure, and if they had obtained the same prices for sulphate and tar, and taking into consideration the items of assessment and stoppage, they would have had a profit of £8570. These were extraordinary items over which no committee could have control. He warned the Chairman of the Finance Committee that, in future, he would not have to look for so much assistance from the Gas Department. He reminded the Council that Burnley was not the only town where there had been decreases in the gas profits. At Nelson, the estimated profit was £3082, but it was only £190; at Darwen, there was a loss of £1900; and at Blackburn, where the charge for gas was already 6d. per 1000 feet more than in Burnley, they had had to increase the price.

At the last Meeting of the Nelson Town Council, the Chairman of the Gas Committee (Mr. Alderman Hartley) was called upon to explain the deficiency shown upon the gas accounts for the past year. He said he stood in the position of one who had either overspent or underearned a very considerable sum of money. At the beginning of the financial year, his Committee estimated a profit of £3000. No doubt the estimate was made at a time when they were very sanguine; and had it not been for the lessened revenue by reason of the Oldham strike, the Committee would not have been so far wrong. It was his unpleasant duty to have to report the first decrease in the manufacture of gas in the history of the Nelson Gas-Works. The revenue during the past four years had been: Year ending March, 1889, £11,187; March, 1890, £13,840, an increase of £2653; March, 1891, £15,369, an increase of £1529; and March, 1892, £16,725, an increase of £1356. The Committee naturally expected there would be a proportionate increase for the year ending March, 1893. However, it had not been so; and considering that the average increase for the four previous years had been £1845, and that the gas-works had failed to yield any profit this year, the remaining deficit was largely accounted for. If matters had gone on as the Committee expected, they would have made a profit of £3128.

ST. HELENS CORPORATION GAS SUPPLY.

The Past Year's Working—Reduction in the Price of Gas—The Young Oil-Gas Process.

At the Meeting of the St. Helens Town Council on the 7th inst., the Gas Committee reported that, as the result of the inquiries into the various methods of increasing the illuminating power and reducing the price of gas, they had resolved to adopt the Young oil-gas process, at an estimated cost of £1000. The profit for the year ending the 31st of March last was reported to be £2895; and it was resolved that £1224 of this sum should be applied to the extension of mains and services, and that the balance of £1671 should be paid into the borough fund account. It was decided, as mentioned in the JOURNAL last week, to reduce the price of gas 1d. per 1000 cubic feet, and for the gas consumed through prepayment meters to 3½d. per 100 cubic feet. Alderman Cook, in moving the confirmation of the Committee's minutes, stated that the price at present charged to the users of prepayment meters was 4d. per 100 cubic feet. The gas receipts for the year had been £12,890, out of which the Committee had paid for interest and sinking fund £9995; leaving a net profit of £2895. This was about £150 more than the previous year. The gross rentals had been £1394 more than in the year 1891-2. They had sundry receipts, rents of property, and other small matters amounting to £253; so that they had had £1647 more than before. Against this they had received for residuals £972 less. As to the quantity of gas made, the increase had been 4·78 per cent. on the previous year; and that of the gas sold, 5 per cent. The unaccounted-for gas had been exactly the same as before—viz., 1 per cent. The cost of the production of gas was about 1¼d. less than in the year 1891-2. He congratulated the Council on being in a position to recommend a reduction in the price of gas, while a number of neighbouring towns were increasing their charges. This indicated that the policy pursued by the Committee and the Council had been a sound and steady one. As to the new gas-making process which the Committee proposed to introduce, there were many advantages to be obtained by its adoption. The Committee had gone fully into the matter, and were convinced of its efficiency. Mr. Hatton asked if small cottage owners were allowed any discount. Alderman Cook said they were not, unless they burned a certain quantity of gas. The principle upon which discount was fixed was obtained from actual figures as to the cost. Some years ago the Committee took the trouble to analyze these figures, and the discount allowed was, the Committee thought, reasonable and fair between large and small consumers. Mr. Forster said the tenants of cottages who used prepayment meters had a reduction of 5d. per 1000 cubic feet, while the others had only one of 1d. The small consumers therefore had the benefit. The minutes were passed.

NEATH CORPORATION GAS SUPPLY.

The Engineer and Manager of the Neath Corporation Gas-Works (Mr. R. A. Browning) has lately presented to the Gas Committee his annual report. It shows that out of a sum of £55,500 borrowed on account of the gas undertaking, £28,767 has been repaid; leaving a balance of £26,733. There was a profit of £2230 on the working; being an increase of £423 on the previous financial period. Mr. Browning says that, in making a comparative statement of the different accounts, there has been a saving of about £136 in the cost of coal, owing to a lower contract, although the price is still higher than formerly. Wear and tear, &c., show an increase of about £100; but in the item of manufacture of gas, there is a slight saving of about £30. With regard to rates and taxes, the gas undertaking, in common with most of the ratepayers, has not been dealt with lightly in the past assessment, as it has had to pay at least £120 more than formerly. This account is very objectionable, as £450 out of twelve months' working rather handicaps the management. On the other side of the accounts, there is again a substantial rise in the gas-rental of about £396, owing to increased consumption. The residual products, with the exception of coke, are still very low—the price of tar being at least 50 per cent. lower than formerly; but having gained in the manufacture of sulphate of ammonia, the results are much the same as last year. The profits on fittings and rent of hired fittings and gas-stoves show an increase of about £56. Subject to approval, Mr. Browning, has disposed of the net profit as follows: After paying £1150 interest on all loans, and £92 to the bank, £100 has been carried to the depreciation fund account, and £600 to the repayment account (which goes towards the reduction of the principal, thereby relieving the rates every year); leaving a substantial balance of £1112 to be carried to the next account. Mr. Browning calls attention to the favourable results of the last year's working, which is due in great measure to the completion of the many renewals and improvements to the works which have been going on for some time past. He has carbonized only 28 tons of coal more, which would mean in the make of gas an increase of about 280,000 cubic feet; but he has made 778,000 cubic feet—a rise of 498,000 cubic feet. He has sold to private consumers 1,687,000 cubic feet; or an increase for the twelve months of 1,967,000 cubic feet. The make of gas per ton of coal carbonized was 10,012 cubic feet. These results have not been obtained at the expense of the illuminating power of the gas, which has been kept at least 2 candles above the standard.

BUENOS AYRES (NEW) GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Wednesday, at the London Offices, 1, East India Avenue, E.C.—Sir WILFORD BRETT, K.C.M.G., in the chair.

The SECRETARY (Mr. E. W. Layton) read the notice convening the meeting; and the Directors' report and the accounts for the year ending Dec. 31 last were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that the keynote to the substance of the explanations he had to place before the shareholders might, he thought, be very appropriately summed up in the single word "improvement," because an improvement, he believed, had really set in. He said this as an examination of the accounts disclosed these facts: That, whereas the working of the Company during 1891 resulted in a net profit of only £393, and a portion of the amount necessary for the payment of debenture interest had to be taken from the reserve fund, this year they showed a gross profit of £11,585, in addition to the sum of £7226 which had been recouped to the reserve fund. The exceptional trouble with which the Directors had had to deal had been the shadow of uncertainty which permeated all their dealings, owing to the varying and moving currency, and also the variations in the premium on gold. In preparing the accounts, they had to state them, in the first instance, in the currency of the country, and then to re-state them in the gold premium according as it might rule at the particular time at which they had to state them. Thus, in the form in which the accounts were now before the shareholders, the results were really almost entirely fixed on the price of gold; and this produced occasionally very great anomalies, which were due only to the permutation of the currency, and not to the management. But this made it very difficult and confusing to discuss the several items of the accounts; and therefore it was safer and better, in order to obtain the result of the working at the end of the year, to take the figures when all the permutations had been completed. As an illustration of what he meant, he said that, in examining the accounts of any company in Buenos Ayres where there were certain items paid in gold—such as salaries—it would be found that, in 1892, they were larger than in 1891; and the first impression might be that there had been an increase. It was not so; it was simply owing to the augmented value of paper. To give a further instance: In 1891 their total receipts were $2,182,493 paper, which at par would represent £433,000, as against, in 1892, $1,989,000 paper, representing £394,000. But the receipts in 1891 were permuted at 378 per cent. in June, and at 373 per cent. in December, and only gave £115,673 in sterling; while those for 1892 were permuted in June at 310 per cent., and in December at 293 per cent., and realized £132,245 in sterling. Thus it would be seen that, although the receipts in 1891 were greater by $193,000 than in 1892, when permuted they were £16,572 less than the smaller receipts of 1892; or, to put it another way, the receipts for 1892 showed £16,572 sterling more. This illustrated how difficult it was to control the results when the premium on gold was always varying; and therefore it was a constant source of anxiety to the Directors. They knew that the business was doing well—that they had extra customers, and were making gas cheaper; but they did not know what the figures were going to work out at at the end of the year when they had to be permuted, because this was determined by the price of gold at that period. He referred next to the fact that Buenos Ayres seemed to be increasing in prosperity in an extraordinary way; and stated that financial rehabilitation appeared also to be going on satisfactorily. In a commercial direction, they were favoured in the present year by the lower price of coal. They had succeeded in securing coal for the whole of this year at an extraordinarily low price; and, all the circumstances remaining the same, the profit ought to be again very much higher. Their Manager (Mr. Lewis T. Wright) was experimenting with different mixtures of coal, in order to try to create a greater economy in this way; and the subject of using mineral oil as a substitute for cannel was engaging his attention. The Directors were also considering the question of sending out coal by steamer, because they hoped a large saving might be made if the freights continued as they were now. In presenting the Directors' report, it was right he should mention that they had not been able to take all the advantage they could have done from the improved premium on gold, for this reason: That one of the competing Companies reduced the price of gas; consequently the other Companies had to follow suit. The ostensible reason for lowering the price was that more would be consumed, and the question of the electric light would be deferred; but, as a matter of fact, he (the Chairman) did not believe electric lighting had made any progress at all in Argentina. There were a few other items affecting the Company's operations during the past year, which the shareholders would like to hear of, because, while they reflected much credit on their Manager, they were also of importance in showing economy in every branch of the undertaking. In the first instance, the quantity of gas made in 1892 was 311,225,000 cubic feet; and the amount of coal used was 28,759 tons. The quantity of gas yielded per ton of coal carbonized was 10,822 cubic feet. The number of private meters fixed rose from 10,191 to 10,521; and the proportion of private lighting as against the public advanced from 59·56 to 62·60. The number of public lamps on Dec. 31 last was 5194. During the year they had repaired 2006 meters on the works; made 258 meters entirely new, at a cost of much less than the cheapest meters they had imported; and made up 604 meters, employing the old drums of condemned meters, at a cost of half the price of those which were new throughout. The number of fresh services laid had been 1052. There had been some reduction in the quantity of gas unaccounted for. There was little doubt that robbery of gas went on very largely by the doctoring of meters in Buenos Ayres. They had the best men employed in its detection; but their great difficulty was that, when they did detect it, it was almost impossible to obtain a conviction. Still they were doing their best; and their Manager estimated that, notwithstanding these robberies, about 2 per cent. would cover the whole of the loss by leakage. In this connection, they had also to meet this difficulty: That nearly the whole of the streets of Argentina had been taken up by the Municipality for the purpose of paving; and this had produced a considerable waste of gas. Negotiations were still being carried on with the Municipality with regard to the public lighting. The Directors were of opinion that the Company were not being paid more than they ought to be; but there was this advantage in having the public lighting in their hands: That, as long as they had it, their mains could not be interfered with; while the mains of the other Companies were entirely at the disposal of the Municipality to do what they liked with them at any time. Their Manager reported that the whole of the plant was in good condition, and that, with the addition of the necessary retorts, he would be able to deal with a quantity of gas equal to 2 million cubic feet per day. He need not say that, after such a violent convulsion as that which had been bearing the Company down, it would take some time for affairs to get round again and confidence restored; but he thought they were growing better. He had hoped as a proof of this to be able to recommend that day a small dividend on the past year; and the amount out of which he had looked to do this was the £7226. He had hoped to appropriate this; but he was told by the Auditors and his brother Directors that it would be more proper and right for the amount to be repaid to the reserve fund. However, he was happy to say they had received from the Company's Committee in Buenos Ayres a telegraphic report (which had been confirmed), which would enable the Directors before very long to declare a small dividend on the first half of the current year. He trusted this was only the harbinger of better things, and that they would soon be restored to the condition in which they were previously.

Mr. F. J. HESELTINE seconded the motion, which was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. J. C. IM THURN, Mr. Heseltine was re-elected to his seat at the Board, as was also Mr. R. J. Neild, on the motion of Mr. IM THURN, seconded by Mr. R. NESHAM.

The usual complimentary vote to the Chairman and Directors concluded the proceedings.

The Danger of Electric Fittings in Dwelling-Houses.—A correspondent has forwarded the following as an example of the danger attending the use of electric fittings in dwelling-houses. During a destructive thunderstorm which broke over Huddersfield on the morning of Sunday, the 4th inst., the house of a Mr. H. Kilner, of Kirkheaton, sustained considerable damage. Mr. Kilner states that just before eleven o'clock he heard a tremendous crash. The house was plunged into darkness, and he was struck on the head and shoulders by flying furniture, and his neck was cut and seared. It seemed as if a bomb-shell had exploded in the middle of the floor. He was stunned for a moment; but, groping round for the children, of whom there were three, he made for the door, but found it blocked by fallen boards, which had come from the passage partition. When Mrs. Kilner and the children got out of the house, it was found that one of them was slightly scorched, but otherwise uninjured. Every picture was stripped off the wall and smashed to atoms. The floor flags were lifted up and damaged in several places, and the cupboard doors, the mirrored sideboard, and the chairs were broken. The house will have to be completely refurnished. The lightning also struck the house occupied by Mr. G. Kilner, Mr. H. Kilner's father, and an eye-witness states that as he was going up the road in the direction of the houses he felt himself lifted off his feet, and nearly deafened by the crash. He ran forward, and saw Mrs. George Kilner come out of the house, her face covered with soot. In Mr. G. Kilner's house there was a small electric bell; but the bell had vanished along with the wire, while the button was found a considerable distance from the house. Some of the back windows of the houses were blown 30 yards or more; and much damage to furniture was also done at the house of Mr. G. Kilner. It is variously estimated at from £100 to £200.

The Water Supply of Temple Newsam.—An inquiry, in which the inhabitants of Halton and Temple Newsam were greatly interested, was recently held at Halton, by Major-General Crozier, respecting an application made to the Local Government Board by the Rural Sanitary Authority of the Hunslet Union for powers to borrow £3500 for works of water supply for Temple Newsam. In support of the application, Mr. R. Emsley explained that the present water supply was obtained by means of the plant provided by Mrs. Meynell-Ingram. In 1881 it was drawn from wells and from a mine drift; and, in consequence of complaints, the Local Authority entered into negotiations with Mrs. Meynell-Ingram, with the result that an agreement was come to whereby the Lady of the Manor contracted to supply good water to the inhabitants generally—she having previously served her own tenants only. The Local Authority, on their part, undertook not to obtain any other supply so long as that furnished by Mrs. Meynell-Ingram remained good. The Medical Officer had of late years repeatedly expressed the opinion that the water was not satisfactory for drinking purposes; and about a year ago the Local Government Board decided that it must be obtained from another source. An arrangement had been entered into for the supply of water by the Leeds Corporation at 9d. per 1000 gallons, from the reservoir at Moortown; and the question to be decided was what was the best means of distributing it. There were two courses open—one to use the whole or part of Mrs. Meynell-Ingram's plant; the other to lay entirely new mains. The Local Authority had decided that the latter would for many reasons be the better one to adopt. Evidence was then called. Mr. Rhodes said he estimated the cost of the works proposed to be carried out at £2997, including £200 for contingencies; and Mr. Emsley stated that they wished to reduce the amount to be borrowed to £3000. Mr. L. A. Kershaw then addressed the Inspector on behalf of Mrs. Meynell-Ingram, and pointed out that this lady had done her best to supply the district with water, and had spent £8000 on plant, a large part of which might be utilized with advantage; and, on behalf of his client, he offered the use of it for an indefinite period free of cost. Mr. T. Fenwick and Mr. Farrar (agent of Mrs. Meynell-Ingram) then gave evidence in favour of the use of a portion of the present plant; and the inquiry closed. The question of the water supply of the above-named places was recently before the Courts (see *ante*, pp. 599, 745).

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the Offices, Southwark Bridge Road—Alderman Sir H. E. KNIGHT in the chair.

The SECRETARY (Mr. Alfred Jelley) having read the notice convening the meeting, the report and accounts, which were briefly referred to last week, were presented.

The CHAIRMAN proposed the adoption of the report and accounts. He said he did so with satisfaction, because, looking all round, he thought the shareholders had nothing to complain of in the position of the Company. Everything, indeed, looked favourable and satisfactory, except one little matter, which, no doubt, was present in their minds. He would, however, show that this had arisen from circumstances over which they had had no control, and that it was in no way any indication of any falling off in the prosperity of the undertaking. This, as he had often said, was what they called the bad half year—the one in which their income was very much smaller than in the other; and it was the half in which the increase they looked forward to in the revenue was not so great. Moreover, in the past six months, they had been subjected to circumstances which had materially increased the charges for maintenance—circumstances entirely beyond the control of the Board, but still such as they must occasionally expect, and be prepared to meet. He alluded, in the first instance, to the severe frost during the winter, which put the Company to very large expense in providing temporary supplies, and which also carried a large outlay in another way, because, during this time, although it might appear anomalous to the shareholders, they had had to pump a very much greater quantity than in ordinary times, on account of pipes bursting and people letting their water run. Then, they had also had to contend with the long period of rain which followed the frost in February, and which made the river water in such a condition that it materially increased the cost of filtration; causing them to cleanse their filters every few days, in order to keep up the supply of filtered water in their district. These were circumstances which they could not govern. Another cause had affected them which they were seeking to control—namely, the increase in their rates and taxes, which was no less than £686, as compared with the same item in the corresponding half of last year. There was also another extraordinary item —"extraordinary" in the sense that it was not one which they might expect in the usual way. He mentioned last year the great success which had attended the laying of the 42-inch main, and said how astonished the Directors had been that there had been no faults discovered in it during the time the contractors had had to keep it in order. It was, however, no uncommon thing when a new main was laid to a length of more than 20 miles—and this one extended over 24 miles—to discover little defects arising in the first years; and those sometimes involved a good deal of expense. During the past winter —possibly the severe frost had had something to do with it, although he could not say—some faults were discovered in the main, and they had to correct them, which imposed a further unexpected charge on the Company. These items amounted to no less than £4000; and, if the proprietors looked at the figures, they would see that the item of maintenance amounted this half year to £41,700, against £37,700 in the corresponding period of last year, which was just the difference of £4000. This was not all, for they had to contend with the difficulties of the times; and the increase of houses in their district had not been so great as they had been accustomed to in other half years. Putting these reasons together, the proprietors would see at once that, in being asked to accept a little pinch in the way of dividend, the pinch was caused by the unusual circumstances he had mentioned, and did not in any sense indicate deterioration in the position, progress, or prosperity of the Company. It was gratifying to find that, notwithstanding these circumstances, they had had an increased revenue of £1400; but it ought to have been something like £2000 or £2500. Nevertheless, they had had the increase of £1400, which showed that the vitality of the Company still continued. The result of these figures was that they had to carry forward to dividend and interest account £56,560, against £58,000 in the corresponding period of last year. Not only did they carry forward £1500 less than they did a year ago, but they also had to pay £2000 in excess of the sum paid last year for debenture interest. These were circumstances which would, he thought, fully explain why they had to submit to the pinch he had mentioned; and he hoped the shareholders would regard them as reasons which might be accepted by business men as perfectly satisfactory. As to their capital account, they had still £26,000 unexpended of the last £100,000 of debentures they raised; and this would, he hoped, be sufficient to carry them on for the whole of the present and the beginning of next year; and they would defer till the last possible moment the raising of more debenture capital to carry out the works it was necessary to construct. Rapid progress had been made in the past half year with the new filter-beds. They had entered into a contract with Messrs. Aird and Sons for certain filtration works, which were absolutely necessary to meet the requirements of the Company's district; and also one for the construction of a large storeage reservoir at Hampton—the Company not possessing so much storeage as some of the others. This reservoir would hold 90 or 100 million gallons of water; and it would be a first instalment towards creating those reserves of water which he was quite satisfied the recent inquiry by the Royal Commission had shown to be a necessity for the Water Companies to provide. That inquiry would, they believed, thoroughly prove that, in the area of the Thames basin, there was ample water for the requirements of the Metropolis for very many years to come; and, assisted by storeage, he had no doubt whatever that there would be a sufficient supply without going to Wales, at a cost of £100,000,000, for a much smaller watershed than they had at their doors. He did not think anything could be cited stronger in support of this view than the fact that, although there had been a drought of some four months, there was not the least difficulty in meeting the requirements of London in regard to water. A short time since, the Royal Commissioners made an inspection of the Thames after, he thought, some three months of drought, to ascertain the quantity of water that was going over the weirs. He believed, notwithstanding the drought, that they found a full supply passing over, and that hundreds of millions of gallons of water were running to waste. This showed that the Thames would be able to meet any requirements. As the proprietors knew, the Directors had for many years been sinking a well at Streatham; and, after a good deal of difficulty, it was at last duly approved by the Local Government Board as a source of supply. They had now proceeded so far with it that they had entered into a contract for the completion of the works; and he supposed this would be done in the course of a year. They would there have a source of water independent of the Thames from which they would obtain a few million gallons a day. These were all matters of the utmost importance requiring the attention of the Board, who felt that their first care should be that no fault should be found with them in the performance of the duties which Parliament had imposed upon them. Bills had been promoted affecting their interests; and these measures increased in number almost every year. This year, perhaps, more than usual they had had to fight certain Bills promoted by the London County Council, which they felt was very unfair indeed. There was a clause in their General Powers Bill to enable that body to spend £10,000 of the ratepayers' money in making inquiries. This simply meant to harass the interests of the Water Companies, and to put them to expense. They had done their best to resist this clause. Then the clause about betterments sought to levy an extra rate in certain districts supposed to be benefited by improvements. He felt that nothing could be more unjust than to tax the Company's mains in connection with such a proposal. The matter had been fought very hard before the House of Commons Committee; and he was happy to say that the clause would, he believed, be agreed to in a way which would very properly exempt the mains of the Companies from the proposed increased rate. This position had not been arrived at without expense and trouble. The Company were gradually getting into a better position; and he believed the undertaking was never in a more satisfactory condition than at the present time.

Mr. C. M. VIALLS seconded the motion.

The CHAIRMAN, in answer to a question, stated that they carried forward £8000 a year previously to meet losses; but, in the preceding half year, they carried forward £6000, which had been found more than sufficient for the purpose—only £4600 having been required. On the present occasion, therefore, they carried forward only £5000. The amount of bad debts for the half year was shown in the revenue account to be £628.

Mr. PETO said he was a shareholder in several other Water Companies which had maintained their dividend, and which did not appear to have been affected by the frost. At the end of the report, the Directors stated that the reduction of the dividend was owing to the severe frost and the law and parliamentary expenses; but, comparing the amount with that time last year, the increase was only £114. He had the accounts of five years ago; and he found that the increase in the debenture debt in that period had been £364,000. Of course, he knew that this had been necessary; but, on the other hand, it was unfortunate to have to bear the burden in this way; for, although the income in the five years had increased by £7638, which was very satisfactory indeed, they were in a worse position by £5154 as far as regarded the amount available for dividend, compared with March, 1888. Their dividend in 1883 was 8½ per cent., and in March, 1890, it was 7 per cent.; and now they had come down to 6 per cent., with a smaller sum carried forward for losses.

The CHAIRMAN, in reply, said it was true that in 1883 they paid a dividend of 8½ per cent.—or some time ago they did so; but after that came the Bill of Mr. Torrens, which brought their income down by £33,000 a year, or equal to a dividend of 3 per cent. Against this they had had to fight. It was also true that in 1890, for one half year, they paid 7 per cent; but this was rather a mistake, because they had to go back to 6½ per cent. He could not go into the question of how other water companies had been affected by the frost, the cleansing of their filters, and the extra pumping of water, because he did not understand their systems; but he knew that the figures he had given to the meeting were facts as regarded the Southwark Company.

The motion was then put, and carried unanimously.

The CHAIRMAN next proposed the declaration of dividends at the rate of 5 per cent. per annum on the preference stock, and of 6 per cent. per annum on the ordinary stock and "D" shares.

Mr. VIALLS seconded the motion, and it was adopted.

The CHAIRMAN said he had omitted, in replying to Mr. Peto, to mention that the Directors had taken into consideration a very heavy bill they would have to pay in the current half year; this being an additional reason why they had recommended a smaller dividend. The proprietors had no conception of the enormous labour and expense entailed in placing before the Royal Commission facts to refute the hostile statements which had been made before them in regard to the water supply. The Water Companies had done their work in such a way that the whole nation ought to thank them; and they had proved, he thought, that those statements had really no truth in them.

Mr. GIVENS then proposed the election as an Auditor of Mr. J. D. A. Norris, F.C.A., in the place of the late Mr. Hertslet.

Mr. PHILIPS seconded the motion.

Mr. PETO proposed, as an amendment, the appointment of Mr. John Young, of Messrs. Turquand, Youngs, and Co.

Mr. W. I. CARR seconded the amendment.

The CHAIRMAN stated that there could not be the least objection to Mr. Young; but, in view of what was laid down in the statute (which he read), he could not submit the name of that gentleman to the meeting, as he was not a shareholder.

After some further discussion, Mr. Norris was elected; and the meeting closed with the usual complimentary vote.

Sales of Shares.—At the Auction Mart, Tokenhouse Yard, last Wednesday, Messrs. Fox and Bousfield sold portions of King's shares in the *New River Company* at the rate of from £84,000 to £88,400 per share.——On the previous day, at Chatham, 22 £5 shares in the *Brompton, Chatham, Rochester, and Gillingham Water Company* were disposed of, at the rate of £15 2s. 6d. each. Three "B" (£10) shares in the *Rochester Gas Company* fetched £19 10s. each; and three "A" (£50) shares realized £113 apiece.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday, at the Offices, No. 65, South Molton Street, W.—Mr. F. TAGART in the chair.

The SECRETARY (Mr. J. Goodwin) having read the notice convening the meeting, the report and accounts, which were mentioned in the JOURNAL last week, were presented.

The CHAIRMAN stated that there was a time when the chairman of a water company could have proposed the adoption of the report, and have given an explanation of the accounts and of the condition of the works, in a very few words. He thought, however, that he must now go farther. At least, unless he was mistaken, the proprietors would expect him to allude to important events passing outside, so far as they bore on the position and prospects of the Company. He could, however, do so briefly, because at their last meeting Lord Knutsford, who then kindly acted for him, made the shareholders fully acquainted with every matter of interest up to that time. With reference to the accounts, the charge for the maintenance and repair of mains had been very heavy indeed in the past six months; and whereas a year ago they were enabled finally to extinguish the debt in connection with the Dorney scheme, this year they had been overtaken by a severe frost, which had entailed an extra outlay of no less than £800. There had also been additional expenses in connection with the double filtration, to which he would refer again. These circumstances accounted pretty well for the increase in the expenditure on revenue account. There had also been an advance in the rates and taxes, which pressed heavily upon them. If they were to go back for ten years, they would find that the rates and taxes had increased by about one-half. The amount paid about ten years ago was, he believed, £12,000 a year; whereas now it was over £18,000. On the other hand, they must remember that the works had been enlarged in this time; and all that the Board could do was to see that the parochial authorities treated them upon reasonable and equitable terms. The commission to collectors was also higher; and the parliamentary expenses, too, were somewhat heavier than they were a year ago. He should, however, be deluding the proprietors if he led them to expect that the latter would be diminished in any way in the next accounts; on the contrary, they would be larger, because they would be obliged to include the outlay in connection with the evidence brought before the Royal Commission, which they shared with the other Water Companies. These charges had not been finally settled. Turning to the other side of the accounts, the water-rents had somewhat improved, though they were not quite so elastic as could be desired. The result of the half-year's working was that they had available for distribution the sum of £49,757, which enabled the Directors to offer the proprietors a dividend of 8½ per cent., as before, which they hoped would be regarded as satisfactory. The Directors had lately paid a visit to the reservoirs at Ealing and the works at Kew and Hampton; and they found them in very good condition. The whole of the Company's district, with the exception of a portion of the parish of St. George's, was now under constant supply; and this part would be placed under that system in November next. No doubt this would be attended with some waste; but they were endeavouring to check this evil, as far as they could, by the appointment of inspectors. Fire hydrants were being attached to the Company's mains; and before next spring the whole of the district within the Metropolitan area would be well supplied with hydrants. In both these matters the Directors had endeavoured, as quickly as possible, to carry out the behests of the London County Council. This body had a General Powers Bill before Parliament. Part of the power sought provided for the representation of the Council on the Thames and Lea Conservancy Boards; but he was happy to state that, so far as the Thames was concerned, the House of Lords decided on the previous day that this claim was not proved. If it had been, they could not suppose it would have been carried out for the benefit of the Companies. The Council had also applied for power to spend not exceeding £10,000 a year in prosecuting further inquiries. He trusted, however, that reasonable counsels would prevail, and that, in face of the exhaustive inquiry that had gone on, the Council would not bring any further heavy expenses on the Companies. He really thought there were certain indications of less hostility towards them among the more eminent members of the Council; and perhaps this changed feeling might have been brought about by the fact that the Companies have been able to show that their interests were not antagonistic to, but were identical with, those of the ratepayers. They had more than once received a friendly hint from General Scott that their storeage capacity was not quite up to the mark, and that it would be wise to supplement it. The Directors were fully alive to this; but they had hesitated to incur any considerable outlay at Hampton, because the very persons who at the time were reflecting upon them on account of their alleged shortcomings would have been the first to cavil had they done so. When, however, the Dorney scheme was finally abandoned, and the aspect of things was somewhat changed, they were enabled to purchase a plot of land adjacent to their works, and admirably adapted for a reservoir, sufficient—perhaps more than sufficient—for the purposes of the Company either in the immediate or the distant future. In due time they proposed to utilize this land, which, in any circumstances, was an excellent purchase; and, in the meantime, they would be able to employ the double filtration process, which was fully explained at the last meeting by Lord Knutsford, and which, thanks to the exertions of the Company's Engineer (Mr. Fraser), the Directors had been enabled to bring into use. They would be able to increase this system, and thereby keep themselves well abreast of the times, and to afford a good and abundant supply of wholesome water. Although comparisons were odious, he might mention that Dr. Frankland's report showed that the water of the Grand Junction Company would compare favourably with that of any other Company serving the Metropolis. The supply of good water was very important; and, notwithstanding the drought, their mains had not failed them. The Registrar-General's reports showed that London was one of the healthiest cities in the world; and this could hardly be so if the supply of water were deficient and impure. The Directors had remodelled the arrangements of the office. Mr. Fisher, who about six months ago was very ill indeed, had on this account retired from the Company's service; and Mr. Goodwin had been appointed Secretary. As regarded the Royal Commission, he did not wish to detract from the well-deserved tribute which Lord Knutsford paid on the last occasion to Mr. Fraser and Mr. Hunter for their services. He would not have referred to the masterly document drawn up by these gentlemen but for the fact that further evidence had been given in the matter, and engineers of eminence had testified to the excellence of the scheme proposed—in fact, they had approved of the site suggested on the Thames for storeage purposes. He might also state that, in his opinion, the conclusions of their colleagues had not been in any way upset, or their calculations falsified, by any evidence which had since been adduced before the Commission. He had been glad to see that the Chairman of the East London Company, at their last meeting, had publicly acknowledged the services which Mr. Fraser and Mr. Hunter had rendered; and their scheme was at the time, as the proprietors were aware, warmly received by the Chairmen of all the Companies. It would be folly for anyone to attempt to forecast the nature of the report of the Commission, which they could wait for patiently; but they might be sure that the evidence given by the officials of the Grand Junction Water Company, and the representations made by them to such men as Lord Balfour of Burleigh and the able men who had been associated with his Lordship in the inquiry, would not have been in vain. For many years a seat at the board of any water company had not been a bed of roses; but, so far as their own Board were concerned, they had this consolation—that they worked together cordially and harmoniously. So long as they were encouraged by the proprietors' approval and fortified by their support, they would continue faithfully and zealously to promote the interests of the Company, and thereby the welfare of the large and important district the water supply of which had been committed to their care by Act of Parliament. He concluded by moving the adoption of the report and accounts.

Mr. F. TENDRON, in seconding the motion, said he might supplement what the Chairman had stated by saying that he had the assurance of their Engineer that, so far as he could judge, if the present drought should continue for even two months more, there would be plenty of water in the river; and the river would be the last resort of all the streams of water that had been stored up. He thought this settled another very important point that was contended for before the Royal Commission by many eminent men—that chalk formed an immense sponge or reservoir for water. He believed one very eminent engineer had laid down the extraordinary theory that the greater part of the rain that fell disappeared by evaporation; but he did not think this theory could ever be brought forward again after the experience of the present drought.

Mr. COLES said he thought the expenditure on capital account ought to be brought to the front, and exposed to view as much as possible from time to time, to see what they had in their coffers for capital expenditure.

Mr. R. A. M'LEAN, F.C.A., one of the Auditors, stated that the whole of the assets were on the credit side of the balance-sheet; and to deal with the sum mentioned by Mr. Coles would be to repeat it. He paid a graceful tribute to Mr. Fisher for the careful way in which the accounts had been prepared by him; and said he was sure that gentleman carried with him into his retirement the very best wishes of the shareholders.

The motion was then carried unanimously.

The CHAIRMAN next moved that the dividends recommended—viz., at the rate of 8½ per cent. per annum upon the ordinary shares, 7½ per cent. per annum on the "C" shares, and 7 per cent. per annum on the "D" shares—be declared.

Mr. CHESSHIRE, in seconding the motion, remarked that he had seen in two papers a statement that the Thames at Richmond was so low that it was quite practicable to go across it on foot by making a few jumps. He hoped this might be contradicted, as it gave an impression that their supply was bad, and might subside, or even disappear altogether. The condition of the river referred to was, however, below Teddington Lock, and therefore below the Water Companies' intakes.

Mr. W. HUNTER said he should like to point out that the shallowness of the river at Richmond was not due to the abstraction of water by the Companies, but to the greater freedom with which the tide flowed since the construction of the Thames Embankment, and especially since old Putney Bridge had been removed and the new bridge built. It might be interesting to observe, as the question arose before the Royal Commission, that the volume of the tide was so large that the abstraction of an additional 100,000,000 gallons of water per day for water-works purposes bore a very small proportion to the total flow of the river through London. Mr. More, the Engineer to the Thames Conservancy, informed him some little time since that the average flow per day of an ebb tide was as follows: At Richmond Weir, 305,000,000 gallons; at Kew Bridge, 636,000,000 gallons; at Putney, 1,480,000,000 gallons; and at London Bridge, 2,960,000,000 gallons. The abstraction of an extra 100,000,000 gallons per day, or 50,000,000 gallons of water per tide, was therefore about 1-60th part of the volume at London Bridge. It might be further interesting to know that Mr. More proposed, by constructing a 50,000,000 gallon reservoir in the Old Deer Park at Richmond, to allow the Water Companies to take 100,000,000 gallons of water per day additional without there being any necessity to construct storeage reservoirs up the river.

The motion was carried unanimously.

The retiring Directors and Auditor were then re-elected; and the Hon. Sydney Holland was chosen to fill the vacancy on the Board caused by the death of Mr. Hertslet.

A vote of thanks was accorded to the Chairman, Directors, and staff; and the proceedings closed.

Woodbridge Gas Company.—The working of this Company during the past twelve months resulted in a profit, with the balance of £423 brought forward, of £1153, from which a dividend of 10 per cent. has been declared. During the year the consumption of gas has again shown an increase; but the low prices of residuals considerably lessened the receipts from that source.

SEVILLE WATER-WORKS COMPANY, LIMITED.

The Annual Meeting of this Company was held last Thursday, at the London Offices, 86, Cannon Street, E.C.—Mr. DAVID EVANS in the chair.

The report showed that the income from all sources amounted to £28,216; and, after deducting working expenses, the cost of laying on services, exchange differences, and debenture interest, the net revenue was £9579. Adding to this the unappropriated profit brought forward (£2692), and after deducting therefrom the balance of the cost of renewing debentures at 5 per cent., and charging the contribution of £566 to the sinking fund, and the half-year's dividend to Sept. 30 last, the amount remaining to the credit of profit and loss account was £5920. The Directors recommended a balance-dividend, at the rate of 4 per cent. per annum, free of income-tax, which would absorb £5362, and leave £558 to be carried forward.

The CHAIRMAN, in moving the adoption of the report, said the progress of the Company had been fully up to the Directors' anticipations; the year's revenue having increased by 50,850·72 pesetas. The sterling profits were £9579, as compared with £8062 in 1891-2. The rate of exchange had averaged 29 pesetas, as against 28 pesetas; making a difference to the debit of £650. They had now virtually disposed of all the balance which the Company possessed at the expiration of Messrs. Easton and Anderson's lease in 1890. To continue to distribute a 4 per cent. dividend in the forthcoming year, it was evident that they would require an increased net profit of £1145. Providing that they did not suffer any further loss in exchange, the Directors saw no reason why this should not be easily realized. Their progress in revenue receipts during the past two months had been quite equal to the increase of receipts last year; but, of course, exchange was such an uncertain element that they were not prepared to commit themselves to any promise. He proceeded to refer, with regret, to the loss of the Company's Secretary (Mr. C. Crew), and then mentioned that Mr. Hamilton, who had been Secretary to Messrs. Easton and Anderson during the time the business was in their hands, had been appointed to the vacant position.

Mr. COWLEY LAMBERT seconded the motion, which, after several questions had been put and satisfactorily replied to, was unanimously carried.

The retiring Directors and Auditors having been re-elected,

An Extraordinary General Meeting was held, to authorize the Directors to raise a further sum of £10,000 by the issue of mortgage debentures or otherwise.

The CHAIRMAN explained that the Directors wished to be invested with this authority not because there was any immediate want of money, but to provide against any future requirements. None of the "B" debentures already sanctioned had been placed in the hands of the public; and they had hitherto only been used to facilitate financial arrangements.

The motion was seconded and agreed to.

A vote of thanks to the Chairman and Directors terminated the proceedings.

BRADFORD CORPORATION WATER SUPPLY.

Annual Financial Statement.

At the Meeting of the Bradford County Borough Council last Tuesday, Alderman John Hill submitted his annual budget; and, in the course of his speech, he drew attention to the financial results of the working of the Water Department during the twelve months ending March last, which, he was sorry to report, were not very satisfactory. The receipts for water for domestic purposes were £52,253; for water supplied through meters, £61,641; and for bank interest, rents, &c., £6974—making a total of £120,868. On the other hand, they had payments for salaries and wages, £7425; rents, rates, and taxes, £8603; cost of Gilstead filter-beds, £780; cost of Thornton Moor filter-beds, £507; maintenance and general repairs, £1987; Heaton pumping station, £563; waste-water department, £1138; parliamentary and miscellaneous, £2627; various items of expenditure, £391; and interest and sinking fund, £102,526; or a total of £126,549—leaving a loss on the year's working of £5680. There was a loss last year of £4311; and the total loss for the two years was £9991. This deficiency was made good from a reserve balance of £17,781 which they had in hand, but which would now be reduced to £12,101. He reminded the Council that a very much superior quality of water was now being supplied without any corresponding return. The cost of the filter-beds at Morton Banks, Gilstead, and Thornton Moor had been very heavy indeed; and a large portion of the deficiency during the past two years was the result of the expense that the Corporation had gone to to purify the water. In concluding, he gave some interesting figures, showing the rate at which the income from water had developed during the last eleven years. In 1882, the total income was £83,778; 1883, £85,227; 1884, £91,625; 1885, £92,153; 1886, £97,057; 1887, £101,528; 1888, £108,896; 1889 (fifteen months), £144,283; 1890, £114,843; 1891, £114,315; and 1892, £113,895.

SHEFFIELD CORPORATION WATER SUPPLY.

Annual Accounts.

At the Meeting of the Sheffield Town Council last Wednesday, the Water Committee submitted the accounts for the year ended March 25 last. The outlay on capital account was £21,231; bringing up the total capital expenditure to £2,166,568. The income from water-rates for domestic and trade purposes during the year amounted to £96,634, as against £93,573 in the previous year; showing an increase of £1094 from water supplied for domestic purposes, and £1966 from that for trade purposes by meter—a total increase of £3060. The receipts from meter-rents, house, land and mill-rents, and plumbing work came to £5043; being an increase of £403—making the total income from all sources, £101,679, or an advance of £3463. The expenses of maintenance and management were £19,176; being an increase of £1851. A payment of £200 on account of parliamentary expenses in connection with the Corporation Water Bill made the total working expenses £19,376, or an increase of £2051. The net revenue was £82,302, on which were the following charges: Annuities, £55,170; interest on debentures, Corporation stock, &c., £19,406—total £74,577, or an increased charge of £1297 over the previous year. This left a net profit of £7725 on the year's trading, as compared with £7610 for the preceding year. The fifth annual instalment set aside out of revenue to provide for the redemption of annuities and the extinction of the loan indebtedness amounted to £5784; leaving a surplus for the year of £1941. The accumulated deficiency on March 25, 1892, was £5562; and deducting therefrom the surplus on the operations of the past year, £1941, a deficiency of £3621 was shown, after providing the requisite instalments to sinking and loans funds. The appropriations to the sinking fund during the five years ended Dec. 31, 1892, with earnings thereon, totalled to £29,183. Adding the liability from Jan. 1 to March 25, 1893 (£1372), made the total amount provided from revenue account £30,555. It thus appears from these figures that, against the deficiency of £3621, the capital of the water undertaking has been liquidated by contributions to the sinking fund to the total sum of £30,555. The accounts were approved without discussion.

WARRINGTON CORPORATION WATER UNDERTAKING.

The Town Clerk of Warrington has prepared, at the request of the Water Committee, a report on the accounts of that department for the year ended the 25th of March last. This shows that the profit on the undertaking for the year is £10,618 11s. 6d., from which there has been paid to the Borough Treasurer, for interest and annuities, £9175 16s. 10d.; showing the net profit to be £1442 14s. 8d. The Town Clerk points out that certain items of expenditure, amounting to £640 14s. 6d., should have been charged to capital account; and that, if added to the profit, these would increase it to £11,259 6s. Referring to the repayment of the capital, he mentions the fact that, under the Act of 1890, by which the works were acquired, the sinking fund was suspended for five years; and he says that from July 1, 1896, a sum of £11,212 will have to be set aside annually for sinking fund and interest. It was anticipated that the increase in the revenue during the first three years after the acquisition by the Corporation would amount to £2000; and it is very satisfactory to find that it has exceeded this amount. The net revenue from the undertaking for the year 1889 was £8375; that for the year ending March 25, 1893, being, as before stated, £10,618 11s. 6d. The Town Clerk suggests that, until the payments to the sinking fund are commenced, the annual net profit from the undertaking should be allowed to accumulate, so as to be available in the event of any deficiency in the revenue from any cause during the first year or two; and that, as soon as possible, a reserve fund should be established and brought up to the full amount of £10,000, before any attempt is made to carry surplus profit to the borough fund.

A report has also been made to the Corporation by Professor W. Boyd Dawkins on the probable effect on the Warrington water supply of certain works of sewage disposal projected by the Manchester Corporation at Chat Moss. Professor Dawkins is of opinion that these works will not affect the water supply, because the water does not get into the triassic sandstones from which Warrington is supplied, because the shield of boulder clay under Chat Moss prevents any water making its way into the triassic rocks at that spot, and because the contaminated water will get into the adjacent streams—the Glazebrook and the Irwell—along the surface, in conjunction with the other surface waters.

STAFFORDSHIRE POTTERIES WATER COMPANY.

The Annual General Meeting of this Company was held at Hanley on the 31st ult.—Mr. J. F. WILEMAN in the chair.

The report showed that there had been an increased rental of £795; and the balance for the year, with £2229 9s. 2d. brought forward from the last account, made a total of £19,557. After deducting the interim dividend paid last December, there was a balance of £11,007. Out of this the Directors recommended a dividend at the rate of 6 per cent. per annum for the half year ending the 25th of March (free of income-tax); making, with the interim dividend, 6 per cent. for the year, and leaving a balance of £2307 to be carried forward. The sinking operations at the Hatton works were completed in November last, and resulted in the recovery of a large quantity of water of excellent quality. A covered service reservoir is now in course of construction at Goldenhill, to improve the distribution of water in that locality.

The CHAIRMAN, in moving the adoption of the report, said the Directors were gratified at being able to announce an increased revenue of £795, which would of itself be considered a happy augury for the future. When also it was taken into consideration that the increased revenue followed years of balance-sheets framed on pretty much the same lines as regards elasticity of revenue, they thought the shareholders would not be very far wrong in thinking they had a sound and prosperous business. He found that the increase for the three years ending March 25 last amounted to £502 in 1891, £552 in 1892, and £795 in 1893; making a total of £1849. Previous years showed the same steady, quiet advance in revenue; and for future development they had now an ample and abundant supply of water, and were ready to welcome new customers on fair terms. It might be objected by some of the shareholders that it was rather curious that they had only a finance credit balance of £80, as against the previous years. They could not, however, erect large buildings, put in expensive machinery, and open up extensive business, without making the acquaintance of the overseer and tax collector; and on this occasion they had paid £260 more rates and taxes than in the previous year. They had also paid £450 for extra dividend on new stock, and they had £218 of bad debts, as compared with only £32 last year, owing to the failure of four firms in the Potteries.

The motion was put and carried; and the dividend recommended was declared.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Nothing but gratification can be felt at the outcome of the past year's working of the Edinburgh and Leith gas undertaking.* Two years ago, it will be remembered, the Commissioners landed a balance on the wrong side by £347; and then, frightened by the rise in coal, they advanced the price of gas by 9d. per 1000 cubic feet. In this they overdid the matter; and a year ago they found they had earned a net surplus of £41,497. In October last, having felt their way for a few months, they reduced the price of gas from 4s. 6d. to 3s. 10d. per 1000 cubic feet; and the result has justified the step they took. A business of the sort they administer is always best when the balance-sheet comes out about square. Large surpluses should not be desired; and, of course, deficits, either large or small, ought to be avoided. The net surplus of £2488 which has been realized this year is quite satisfactory; and, together with the sum of £27,180 brought forward, it might, if the Commissioners should think fit, be utilized in wiping out an adverse balance of £12,751 on the capital account—the remainder going to the reserve, which is rather small. On comparing results with the returns for 1891-2, it is found that there is an increase in the quantity of gas sold to the extent of 10,744,200 cubic feet; but as compared with 1890-1, there is a decrease of 16,236,100 cubic feet. It is, however, nearly 128 million cubic feet higher than it was in 1888-9. The revenue from gas fell from £270,917, to £245,036, owing to the large decrease of 8d. per 1000 cubic feet. The receipts from tar and ammoniacal liquor fell from £15,603 to £10,941; and from coke, they fell from £5996 to £3966. On the expenditure side, 132,038 tons of coal cost £112,808, as compared with £125,267 for 135,219 tons last year. The increased quantity of gas sold from a less amount of coal, points either to higher yield or to less leakage—neither of which is given in the accounts. The total manufacturing charges were £164,803, as against £175,429. The accounts are yet subject to audit; but they are prepared with as much care as are the national balance-sheets by the Chancellor of the Exchequer, and may be regarded as final. They will not, however, come before the Commissioners for consideration till the meeting at the end of July.

The Gas Committee of the Glasgow Corporation have this week fixed contracts for about 400,000 tons of coal for the current year, which is within about 50,000 tons of their total requirements. In the matter of prices, they have been exceedingly fortunate, having secured their supplies at an average of about 2s. per ton less than last year, when there was also a reduction. Last August the Corporation advanced the price of gas from 2s. 6d. to 2s. 9d. per 1000 cubic feet; and it is expected that this year they will be able to again reduce it, though whether below the 2s. 6d. is not as yet determined. The gas-rental already shows an increase of upwards of £50,000; but that from residuals shows a decline of nearly £20,000. What the Corporation aimed at, in the increase of 3d. per 1000 cubic feet, was to raise £45,000; and this they have more than done. At the same time, they expected to incur a further loss upon residuals, which has also been experienced. They had to wipe out a deficit of £27,117, which arose in 1891-2, and to meet the loss upon residuals. It looks as though the estimate as to what they would be able to accomplish was correct, and that the year will end satisfactorily. It must, however, be remembered that there is a largely increased charge upon capital expenditure.

The Paisley Town Council have this week had another engagement, over the subject of the proposed Provisional Order empowering them to borrow £20,000 for extensions upon the gas-works. There was some hot skirmishing in the community the previous week, the opponents of the proposal having called in the aid of those vertebrate bodies known as Ward Committees. At those meetings—considering that the speakers were principally drawn from the clamouring, which is almost universally synonymous with the ignorant, order of persons—the arguments were mostly opposed to the proposal to borrow. Fortified by the eloquence of the outside gang, the opposing minority in the Council were very bold, and even went the length of imputing unfair play to the majority, in the allegation that some of them had interfered, after the Sheriff had reported against the proposal, to procure a favourable deliverance upon it from Sir George Trevelyan. It will be remembered that, notwithstanding the Sheriff's opinion, Sir George Trevelyan expressed his willingness to grant the Order, on certain conditions which were the reverse of onerous—the principal one being that the money to be borrowed should be for future extensions only. The Council, by a majority of two, on Tuesday resolved to accept the Provisional Order on Sir George Trevelyan's terms. It is not to be wondered at that they should. As has been before pointed out in this column, the difference in the Council is between those who favour the old practice of making a large gas surplus and applying it to town improvements, and those who take the enlightened view that the Gas Department should only be called to provide for its own requirements. That reform is necessary is apparent, when it is stated that during the past eleven years, out of £53,000 of gas profits, £37,000 has been expended on town improvements. The arguments against borrowing were that there is a large public debt already; that there is a probability of competition with electricity in the near future; that there will be no need for extensions for years to come; and that they can afford to extend the gas-works out of revenue, and even to reduce the price of gas, without additional capital. These are hollow reasons. The large public debt is not on the gas-works; and the gas-works should not bear it. It should be assessed for upon the community, and not upon the gas consumers. If the Gas Department is to compete with electric lighting, there must be ample funds and efficient plant. The annual payment of interest and repayment of instalment would be nothing compared with an emergency outlay after the light was established, or the raising of the price of gas to provide for such expenditure. To starve the works at present would be but to play into the hands of the promoters of electricity. That there may be no need for extensions for some time, is no reason why provision should not be made for them. Besides, the money is not to be borrowed till it is required; and, further, it may be taken for granted that anything which an engineer of such eminence as Mr. G. R. Hislop recommends, must be, if not a necessity, at least a policy of the utmost expediency. If, in the last place, they can afford to reduce the price of gas, why do they not do it? I am very much mistaken if the policy of the majority be not to place the Gas Department on a sound financial basis, and to lead to a reduction in price, by removing the burden of extensions from the revenue to the capital account. That the financial policy hitherto pursued has not been sound, needs no further illustration than the statement that not log ago the Council had exceeded their borrowing powers upon the gas-works to the extent of £16,000, for which the individual councillors might have been held responsible.

Mr. Whimster, the veteran Gas Manager to the Perth Corporation, has again come out satisfactorily at the end of the year. Though the price of gas was retained a year ago at 4s. per 1000 feet, the output has risen from 92 to 97 million cubic feet. The quantity of coal carbonized rose from 8751 to 9400 tons, so that the high yield previously reported has been maintained. The revenue increased from £18,859 last year to £19,545; and the expenditure, which twelve months ago was reported to have been £18,163, fell during the year to £17,544. The credit balance left was reported to the Commission this week as amounting to £2000, to which had to be added £695 brought forward from last year's balance-sheet. The surplus it has been agreed to expend in paying £805 for new mains and £756 for purifiers; placing £1000 to the fund for the repayment of borrowed money, and £112 to the sinking fund to meet interest—leaving a balance to be carried forward of £22. The estimates for the current year were submitted in three forms—on the footing of the price of gas remaining at 4s., in case of its being reduced to 3s. 9d., and in view of the introduction of Young's oil-gas plant. In the first instance, the 3s. 9d. estimate was adopted; and then the Commissioners set about considering as to the introduction of the oil-gas plant. After an explanation of it by Mr. Davidson, who, along with ex-Bailie Gow and Mr. Whimster, had seen the plant at work, it was resolved to adopt the system, and to have it introduced at once. At Perth, on account of the confined nature of the gas-works, the condensers are of the horizontal type, and are hung upon the wall both in the interior and outside of the retort-house, parallel to the retort-bench. It is proposed to hang the condenser for the oil plant on the exterior gable wall of the retort-house. There is quite sufficient space in the house to allow of the requisite number of ovens being set apart for the oil distillation—indeed, in that respect, the system is exceedingly adaptable for Perth, inasmuch as, owing to the richness of the oil gas, it will virtually add to the retort space. It is evidently intended to clear off the total cost of the apparatus out of the revenue for the first year. The department is estimated to cost during the year £3445, in which is included £1000 as the price of the plant, £100 for royalty, and 772 tons of oil at £3 per ton. On the other hand, as some of the effects of the introduction of the system, the coal and lime account is estimated at £7400, instead of £8000 last year; and coke is estimated to produce £1271, as compared with £141 last year. The total revenue is estimated at £19,691; and the expenditure, at £17,368.

The Cambuslang Gas Company, in Mr. J. Donaldson's hands, continues to flourish. They have this year declared a dividend at the rate of 9 per cent., as compared with 7½ per cent. last year, besides adding 1½ per cent. to the reserve and 10 per cent. to the depreciation fund. The yield of gas has been increased by 268 feet per ton of coal; and the leakage has been reduced to 5·17 per cent.—one of the lowest figures obtained. The price of coal was 2s. per ton lower than in the preceding year; but the returns from residuals fell from 8s. 9d. to 3s. 5d. per 100 gallons, which would have reduced their profits to less than last year had it not been for the better working results. The Directors very properly voted an honorarium to Mr. Donaldson, in respect of the excellent results he had obtained.

The Works Committee of the Edinburgh and District Water Trust have resolved, on the advice of Messrs. J. and A. Leslie and Reid, their Engineers, to recommend the adoption of the Manor scheme for the augmentation of the water supply. This was almost inevitable, when the recent reports which have been submitted on the subject are considered. The estimated cost for the first instalment of ten million gallons per day is £652,364. The excessive dryness of the present year is now making it apparent that the Trustees have perhaps deferred too much to the opposition to their augmentation proposals; and the Committee recommend that, in addition to applying for parliamentary powers to introduce the new supply, the whole of the area of supply be, within the next three years, placed under the Deacon or other approved meter system of inspection. The Engineers reported to the Committee a very serious state of matters, in connection with the supply this season. At present the daily supply is 13,372,000 gallons, which is equal to 35·60 gallons per head of the population. Their North Pentland supply is only equal to holding out till the 6th of August; and the South Pentland source, till the 22nd of August. By that date, the Crawley springs on the South Pentlands, which are at present yielding 447 cubic feet per minute, would be reduced to 367 feet per minute; and the Moorfoot reservoirs of Gladhouse and Portmore would be required to furnish the whole supply. The Committee resolved, in view of this report, to at once reduce the Crawley supply by 900,000 gallons per day, which will make it last for three weeks longer, and to bring in a corresponding supply from the Moorfoots. They also decided, in view of the period of stringency arriving when the North Pentland supply fails, to lay a new 12-inch main, at a cost of £3060, to facilitate the distribution of the Moorfoot water in districts which are at present served by the North Pentland supply.

The accounts of the Edinburgh and District Water Trust for the year ending May 15 last, show that the estimated revenue was £83,032: and the actual receipts amounted to £84,142. As compared with the preceding year, the yield from the rates rose from £82,321 to £82,630. The revenue reported a year ago, for the preceding twelve months, was £84,515. The falling off last year was chiefly in the sums recovered for the renewal of distribution pipes, which fell from £1306 to £579. The estimated expenditure was £84,820; and the actual amount was £85,658. This increase arose chiefly upon the outlays in connection with the proposed additional supply scheme. In the preceding year, the total expenditure was £83,325.

* Some statistics in regard to the undertaking will be found in another part of the JOURNAL.

Alarm lest the water supply should fail during the present dry season is extending. Even in Glasgow the Water Committee are feeling some anxiety. There the question is not as to the source of the supply, which is practically inexhaustible, but as to the means of distribution which are at the command of the Committee. At a meeting of the Town Council on Thursday, Mr. Osborne, the Convener of the Water Committee, said he wished to call attention to the waste of water that was going on in the city. The water in the Mugdock reservoir had gone down 4 feet in one day. They were drawing from the reservoir 45,000,000 gallons a day; and as the aqueduct from Loch Katrine would only send in 42,000,000 gallons, they would see that at that rate they would soon empty the reservoir. The normal daily consumption was 44,000,000 gallons; at present it amounted to 50,525,000 gallons. He impressed on consumers the necessity of being more careful in the use of water; otherwise, within a few weeks, they would require to cut off the water altogether during some part of the day.

For the second time, the Police Commissioners of Carnoustie have disapproved of an arrangement with the Dundee Water Commissioners for a supply of water for the burgh. On the first occasion, the objection was more as to the quality of the water which it was proposed to supply; but now it is rather to the charge which the Dundee Commissioners propose to make. The Police Commissioners have accordingly resolved to endeavour to procure an augmentation of their present supply, and to have it filtered.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 17.

Sulphate of Ammonia.—The market is getting excited; and the demand for both spot and future delivery is increasing daily. For near delivery, it is now almost impossible to secure suitable parcels; and the market up to September delivery is well cleared. Quotations for summer delivery range from £12 10s. to £12 15s.; and October-March contracts cannot now be secured under £12, while generally even more is asked. Consumers seem to be entirely unprepared for the turn of events, as the low nitrate prices led them to look for a lower range of sulphate values. The great difference between the prices of nitrate and sulphate (now £4 per ton) is certainly startling.

LONDON, *June* 17.

Tar Products.—This market is now disturbed by a report that large quantities of aromatic hydrocarbons are being produced in the Russian oil centres from the residual oils there. It is said that both the benzol and the anthracene is of first-class quality, and quite equal to that produced from gas-works tars. Fortunately no pitch is produced by this comparatively new oil-cracking process. What with this, and the inundations of benzol from German coke-ovens, the large prospective increased supply from English installations of the same character, and the floods of oils from the Scotch blast-furnaces, the tar distiller's lot at present is not a happy one. There is a better inquiry for carbolic and cresylic acid; but all the other products are as dull and as dead as ditch water. Nominal values may be taken as follows: Tar, 12s. Pitch, 23s. to 24s. Benzol, 90's, 1s. 6d.; 50's, 1s. 5d. Solvent naphtha, 1s. Toluol, 1s. 4d. Crude benzol naphtha, 30 per cent., 7d. Creosote, 1d. Salts, 17s. Carbolic acid, 60's, 2s.; 70's, 2s. 4½d.; crystals, 7d. Cresol, 1s. 9d. Anthracene, nominal, 30 per cent. "A," 1s.; "B," 8d.

Sulphate of Ammonia.—A further improvement in the value has taken place in this market. Stocks are so bare, and the demand so remarkably good, that, so far as can be seen, higher prices will yet be obtained. Business has been done at figures ranging from £12 5s. to £12 15s., less 5¼ per cent. Gas liquor is quoted at 8s. to 9s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no specially new feature to notice with regard to the gas coal trade this week. The general extremely depressed condition of the round coal trade tends rather to increase the keenness of competition for contracts than otherwise; and it may be said that 1s. to 1s. 6d. per ton under last year's prices represents about the basis on which contracts for anything like quantities are being settled. Common screened gas coals only in very exceptional cases are fetching more than 7s. 3d.; and the best screened Wigan gas coals do not average more than 8s. 3d. to 8s. 6d. per ton at the pit mouth—as compared with about 8s. 6d. for common and 10s. for best Wigan gas coal, which represented pretty nearly the general prices last season. The best sorts of round coal meet with only the most limited demand possible; and the lower qualities become, if anything, a still greater drug upon the market. Even with the present very restricted output, stocks are accumulating freely; and excessively low figures are being taken to clear off surplus supplies. Best Wigan Arley coals, at the pit mouth, do not average more than 11s.; Pemberton four-feet and seconds Arley, 9s. 6d.; common house-fire coals, 7s. 6d.; and steam and forge coals from 6s. 3d. to 6s. 6d. per ton. For shipment, ordinary descriptions of steam coal are readily obtainable at 7s. 6d. to 7s. 9d. per ton, delivered at the ports on the Mersey. The scarcity of slack, which is a necessary consequence of the restricted quantity of round coal now being screened, gives a hardening tendency to engine fuel; and outside buyers have, in most cases, to pay special prices to secure supplies. Good qualities of burgy fetch about 6s. 6d. to 6s. 9d.; best qualities of slack, from 5s. 6d. to 5s. 9d.; medium sorts, 4s. 6d. to 4s. 9d.; and common, about 4s. to 4s. 3d. per ton at the pit mouth.

Northern Coal Trade.—The coal trade has been on the whole rather steadier, the demand for some classes of fuel having shown a slight improvement. Best Northumbrian steam coals are in good request, with a fair production; the price being about 8s. 7½d. per ton f.o.b. Second-class steam coals are quoted at about 8s.; and small coals are plentiful at about 3s. 3d. per ton. Manufacturing coal is rather steadier, without any alteration in the price. Some of the producers of gas coal report the price to be rather firmer; but, generally speaking, it may be quoted as from 6s. to 6s. 6d. per ton f.o.b.—one or two exceptionally situated collieries asking 7s. per ton. Coke is now in larger request. For shipment, the demand is fair; and 13s. 6d. to 14s. per ton f.o.b. is the current rate. Gas coke is unaltered in price.

Scotch Coal Trade.—There is a slight improvement in the demand for coal in Scotland; but whether or not it brings better prices with it depends chiefly upon the state of the market in the North of England. The miners are still pursuing a restrictive policy; and they have, it is estimated, brought down stocks by about 20 per cent. There is still, however, a good deal of play in the hands of the coalmasters before they can be compelled to raise wages. The quotations this week are: Main, 5s. 9d.; ell, 7s. to 7s. 3d.; splint, 6s. 6d.; and steam, 7s. 9d. to 8s. per ton f.o.b. Glasgow. The shipments during the week amounted to 136,709 tons—a decrease of 19,962 tons on the preceding six days, and of 19,965 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 2,817,085 tons—a decrease as compared with the same period of last year of 367,046 tons.

Exhibitions of Gas Appliances.—The Davis Gas-Stove Company, Limited, held exhibitions last week at Hoddesdon, Stamford, and Wood Green; Miss Cameron, Mrs. Springthorpe, and Miss Johnston giving lectures on cookery. Messrs. W. Parkinson and Co. held a very successful exhibition of gas appliances from Monday to Friday last week, in the Drill Hall, Nuneaton; Miss Thwaites delivering lectures twice daily.

The Drought in Lancashire.—The long-continued spell of dry weather is producing the usual effect in Lancashire, where most of the manufacturing towns are supplied with water from reservoirs fed from moorland streams and springs. Manchester is in sight of the end of its available supply; and the Corporation decided last week on a curtailment of the service as from Sunday last, "unless water should come into the reservoirs in the meantime." This saving clause did not operate; and for the present the consumers in the Manchester area will have to be content with an intermittent supply. The usual pressure is maintained from 5 a.m. to 8 p.m. each day, and is then entirely stopped until the next morning. The Ashton-under-Lyne and District Joint Water Committee have decided upon a similar course of action; the stock of potable water available for their district being stated as only sufficient for five weeks' maximum requirements. Other towns are in less serious straits; for, since the occurrence of a long drought some five or six years ago, many of them have added to their storeage reservoirs. Oldham, Bolton, and Burnley are in this category; while the completion of the Vyrnwy reservoir has placed Liverpool and some of the neighbouring towns out of any fear of a water famine for some time to come.

The Exemption of Machinery from Rating.—The annual meeting of the National Society for the Exemption of Machinery from Rating was held on Tuesday, May 30, at the Westminster Palace Hotel—Sir W. Houldsworth, M.P., presiding. The report reviewed the legislative history of the movement; and, recalling with satisfaction the second reading of the Bill on March 18 last, by 287 votes to 134, remarked that the delay in the enactment of the measure had had the unfortunate effect of emboldening certain Assessment Committees to seek to include machinery in the revaluation of their Unions, and to tax it to a very considerable extent. The Society had resisted attacks of this kind with very considerable success. The Chairman said he feared the prospects of carrying the Bill were very dark indeed, especially during the present session, when the Government had taken up the time of the House, and private members' Bills had little chance of making any progress. He proposed the adoption of the report. Mr. W. Mather, M.P., seconded the motion, and stated that Mr. H. H. Fowler was very anxious to pass the Bill. The report was adopted. It was decided to alter the name of the Association to the Machinery Users' Association, and to extend its objects. It was also resolved to press upon the President of the Local Government Board the urgent importance of securing legislative enactment for the objects of the Association at an early date.

East Surrey Water Company.—The annual general meeting of this Company was held at Redhill on the 10th inst.—Mr. E. Easton, M.Inst.C.E., in the chair. The report presented by the Directors stated that there had been an accession of 322 new customers in the twelve months ending the 25th of March last; and that an encouraging increase had accrued in the revenue. The accounts accompanying the report showed a balance of £3423, out of which the Board had placed £622 to the credit of the renewal and contingency account, which would raise the fund to a total of £4000; and they recommended that dividends of 5 per cent. on the preference shares and 4 per cent. on the ordinary shares should be declared (interim payments of 2½ and 2 per cent. respectively having been made in December last)—leaving £394 to be carried forward. In moving the adoption of the report, the Chairman stated that the Directors had deemed it advisable to extend the new section of arterial main referred to in the previous report from Merstham to Redhill; thus rendering the circuit complete through Caterham, Godstone, and Bletchingley, and through Kenley, Purley, and Merstham. These works were for the permanent good of the Company, although for the present they might not actually be producing income commensurate with the expenditure upon them. Notwithstanding these great outlays, which had in the last few years amounted to nearly £30,000, the Directors were happy to be able still to keep up their dividend, and, after adding a respectable sum to the reserve fund, also to carry a good amount forward. Sir F. Bramwell seconded the motion; and it was carried unanimously. At the close of the ordinary meeting, a special meeting was held for the purpose of authorizing the raising of additional capital by a further issue of shares, to the amount of £10,000, and also an increase in the borrowing powers of the Company by the issue of further debenture stock, to the amount of £2500. The necessary resolutions for carrying this into effect were moved by the Chairman, and seconded by Sir F. Bramwell; and, after some discussion, they were agreed to.

The Bolton Corporation Electric Lighting Scheme.—After a good deal of delay, the Electric Lighting Committee of the Bolton Town Council have agreed upon their final report, and the Town Clerk has been instructed to obtain tenders for the carrying out of the scheme The first part of the work is estimated to cost £20,000; but borrowing powers for £40,000 have been obtained. The Committee recommend an alternating current high-tension system, with transformers. It is intended to provide plant in the first instance for supplying about 4000 lights. If this proves successful, and is appreciated by the public, the supply will be increased to 10,000 lights.

Belgrano (Buenos Ayres) Gas Company, Limited.—The report of the Directors of this Company for the year ended Dec. 31 last states that the accounts are now calculated throughout on a gold basis. Private consumption shows an improvement of 7 per cent., while at the same time the Company have derived a distinct advantage by the diminution in the public lighting. The net revenue amounted to £8771. Deducting from this debenture interest and London charges, there remains £2261 as net profit. The Directors propose to carry this amount forward; and as, in addition, the liquid assets show an increased value of £4390, the amount standing at the debit of profit and loss account is reduced to £7276. Owing to the accounts being now made out in gold, exchange suspense account disappears from the balance-sheet; and the sum of £5000 set aside in a former year as provision for doubtful debts reappears as a reserve for this purpose.

Plymouth Corporation Water-Works.—An inquiry was held at Plymouth last Saturday, by Mr. S. J. Smith, one of the Inspectors of the Local Government Board, into an application by the Corporation for permission to borrow £5000 for works of water supply. The Town Clerk (Mr. J. H. Ellis) explained that the money was required to enable them to finish the blocking of the leat, which had already, in principle, been sanctioned by the Local Government Board. In 1890 they received sanction to borrow £10,000, which at that time it was thought would be sufficient for the purpose. He proceeded to refer to the new water scheme, powers to carry out which, he said, had been conferred upon the Corporation during the present session. The work would take five years to complete; and the question was how were they to get water in the meantime. Last year, between the Head Weir and Roborough reservoir, they lost in waste no less than 1,750,000 gallons of water per day. Since then they had gone on with the blocking of the leat; and the leakage had been reduced to 550,000 gallons. Further evidence of a formal nature was given.

Reduced Gas Profits at Wigan.—At a recent special meeting of the Wigan Town Council, it was decided to increase the local rates 6d. in the pound. It was explained by the Chairman of the Finance Committee (Mr. Alderman Lamb) that one reason for the increase was the lessened profit on the gas undertaking. Last year they had £12,000, but they were told this year they could only have £6000; and he thought the figures quite justified the Committee in the conclusion they had come to. Last year's amount included £3000 from the reserve fund—in fact, they almost denuded that fund; and it was a controversial question whether this was a proper course to take. There was no gas reserve fund now in existence; and it was quite clear that the Committee could only hand over such a sum as their annual operations justified. Alderman Richards, commenting on this fact, said the principal cause of the reduced profit was taking off the meter-rents and reducing the price of gas. There had, he said, been a loss of £3000 on these two reductions; and this was equal to 5d. in the pound in the rates. All this could be laid at the door of what he might call the "popularity hunters." It may be pointed out that the worthy Alderman omitted to take into account one or two facts on the other side. One is that, during the past year (since meter-rents were abolished and the price reduced), the number of consumers has augmented by 666, which is the largest annual increase. Another is that residuals were lower in price, and coal and cannel dearer.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1153.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	15½—17½	—½	6 0 0
100,000	10	"	7½	Do. 7 p. c	10	11½—12½	—½	6 0 0
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 2
100,000	20	31 May	8	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	12 May	6½	Bombay, Limited	5	5⅛—6	..	5 8 4
40,000	5	"	6½	Do. New	4	3¾—4¼	..	6 2 6
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	"	"	8½	Do. New	100	168—173	..	4 18 3
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	104—107	..	4 13 5
320,000	20	13 Apl.	11½	British	20	42—44	..	5 4 7
50,000	10	15 Mar.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	6—7	..	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	98—102	..	5 17 8
150,000	20	24 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	28 Apl.	12½	Commercial, Old Stock	100	241—249	..	5 0 5
165,000	"	"	9½	Do. New do.	100	182—187	..	5 1 7
160,762	"	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130*	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	227—232*	..	5 12 0
200,000	"	"	10	Do. 7 p. c. Pref	100	190—195*	..	5 2 7
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	187—193½	..	5 4 2
486,090	10	27 Jan.	10	European, Limited	10	21½—22½	..	4 8 11
354,060	10	"	10	Do. Partly paid	7½	15—16	..	4 13 9
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	223—228	+5	5 5 3
100,000	"	"	4	Do. B, 4 p. c. max.	100	95—99	..	4 0 10
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	263—268	..	3 14 7
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	170—175	..	4 5 8
1,300,000	"	"	7	Do. H, 7 p. c. max	100	169—174	..	4 0 5
463,000	"	"	10	Do. I, 10 p. c. Prf.	100	262—267	..	3 11 10
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	156—160	..	3 15 0
1,061,150	"	15 June	4	Do. 4 p. c. Deb. Stk.	100	125—128	+2½	3 2 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	128—132	..	3 8 2
908,000	"	"	6	Do. 6 p. c. do	100	167—172*	+1	3 9 9
3,800,000	Stck.	12 May	12	Imperial Continental	100	224—229	+6	5 1 10
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5—5⅛	+⅛	5 9 1
560,000	100	4 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	103—105	..	4 15 3
541,920	20	15 June	5	Monte Video, Limited	20	13—14	..	7 2 10
150,000	5	31 May	10	Oriental, Limited	5	7⅛—8	..	6 5 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	4⅞—5⅛	..	7 3 8
166,870	10	—	2	Para Limited	10	1½—2½	..	—
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98—102	..	5 17 8
150,000	10	28 Apl.	5	San Paulo, Limited	10	8½—9½	+⅛	5 5 3
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	294—299	..	5 3 8
1,350,000	"	"	12	Do. B do.	100	241—248	..	4 16 9
230,000	"	"	13	Do. C do.	100	250—255	..	5 1 11
750,000	"	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	15 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	262—267	..	3 14 11
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	207—212	..	3 15 4
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	142—145	..	3 2 1
700,000	50	15 June	8½	Grand Junction	50	107-110	+2½	3 17 2
708,000	Stck.	10 Feb.	11	Kent	100	278—283	..	3 17 9
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	237—242	..	3 18 6
406,200	100	"	7½	Do. 7½ p. c. max.	100	199—204	..	3 14 0
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129—132	..	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	329—334	..	3 12 8
1,030,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—137	..	2 18 5
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	147-152	+3	3 18 10
126,500	100	"	6	Do. D 7½ p. c. do.	100	140-145	..	4 2 9
1,155,066	Stck.	15 June	10	West Middlesex	100	253-258	+1	3 17 6

*Ex Div.

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HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

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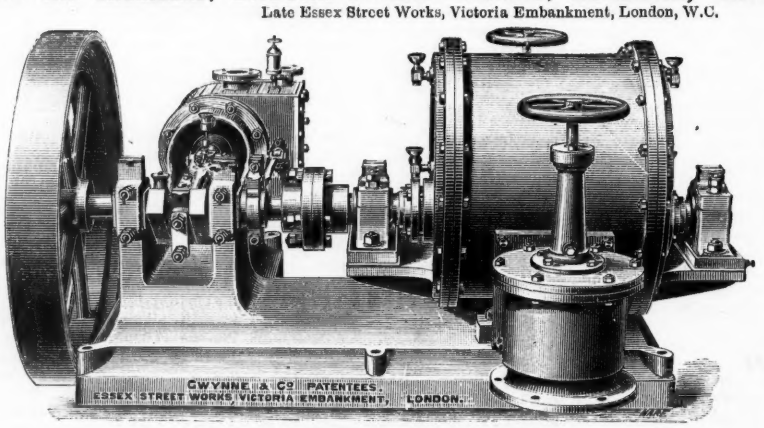

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Write, stating age, experience, and salary required, to "GAS," care of Messrs. Deacon's, LEADENHALL STREET, E.C.

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FOR SALE—Purifier-Valve (Four-way), 6-inch, by Cockey, Frome. In good condition.
METERS, second-hand, two and three light; surplus stock.
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GASHOLDER, 35 ft. by 14 ft.
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Four PURIFIERS, 12 ft. square by 4 ft. 6 in. deep.
Cast-Iron SCRUBBER, 36 ft. high by 10 ft. diameter.
CONDENSERS to pass 500,000 cubic feet per diem.
EXHAUSTER to pass 20,000 cubic feet per hour.
Also various other sizes of above or any Gas Plant. Inquiries invited.
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THE St. Helens Corporation Gas Committee have FOR SALE a TELESCOPIC GASHOLDER, Two Lifts, 30 feet each and 70 feet diameter. Working capacity, about 130,000 cubic feet. Complete with four duplicate Cast-Iron Guide-Columns and Girders. Removal for purposes of Extensions.
Any further Information may be obtained from the undersigned.
Wanted, a small second-hand PURIFIER, with Lute and Cover complete. Area, 40 to 50 square feet.
Lowest offers to be sent to me at these Works.
SAMUEL GLOVER,
Engineer and Manager.
Corporation Gas-Works, St. Helens.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY, LIMITED.

REMAINDER OF PLANT FOR SALE.
SITE MUST BE CLEARED. NO REASONABLE OFFER REFUSED.

ONE Two-Lift Gasholder, new in 1888.
Makers, R. and J. Dempster. Outer lift, 35 ft. by 15 ft.; inner do., 33 ft. 6 in. by 15 ft.
One Single GASHOLDER, 30 ft. by 12 ft., thoroughly overhauled in 1887 by Messrs. R. and J. Dempster (New Columns, and Guide-Framing).
The above are in excellent condition and well worth the attention of any persons requiring Gasholders of the above capacity.
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FOR SALE—Two perfectly new Cast-Iron SCRUBBERS, 10 feet diameter by 50 feet high, with Wrought-Iron Domes, Cast-Iron Spiral Staircase, &c., complete. All plates machine planed. One or both Scrubbers will be sold to suit purchasers.
A perfectly new 30,000 per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
One Second-hand (thoroughly overhauled) ROTARY EXHAUSTER, to pass 7000 cubic feet per hour (without Engine), fitted with Pulleys.
The whole of the above Plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

EXHAUSTER (Rotary), perfectly New (Makers, Dempster and Sons), 30,000 cubic feet per hour, ON SALE, cheap.
Apply to T. G. MARSH, 41, Corporation Street, MANCHESTER.

PURIFIERS.

FOR SALE—A set of Four Purifiers, each 5 feet square, with Grids, &c., lying at the Filey Gas-Works.
For Price and Particulars, app'y to HENRY TOBEY, Gas-Works, Malton, YORKS.

TENDERS for Tar and Liquor Wanted by the Blairgowrie Gaslight Company, Limited. Coals carbonized, 1000 tons.
Address FORBES WADDELL, Manager.

GAS COAL.

THE Directors of the Oakham Gas Company, Limited, invite TENDERS for about 750 tons of good GAS COAL.
For Particulars and Forms of Tender apply to
JAS. MASON,
Manager.
June 17, 1893.

OSWALDTWISTLE LOCAL BOARD.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1893.
The quantity of Coal carbonized is over 3500 tons.
Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.
Endorsed tenders to be addressed to me and to be delivered not later than Wednesday, the 19th of July.
WM. SANDEMAN,
Clerk.
Local Board Offices, Oswaldtwistle,
June 13, 1893.

TO COAL CONTRACTORS AND OTHERS.

THE Sedgley Local Board invite Tenders for supplying 500 to 1000 tons of GAS COAL, the deliveries to be made, at Shut End Siding, at such times, and in such quantities as may be directed.
Sealed tenders, marked "Coal," to reach me on or before the 6th of July next.
The Board do not bind themselves to accept the lowest or any tender.
By order,
JOSEPH SMITH,
Clerk.
Offices: High Holborn, Sedg'ey,
June 19, 1893.

TENDERS FOR COAL.

THE Directors of the Cirencester Gas Company are prepared to receive TENDERS for the supply of from 2000 to 2500 tons of best screened GAS COAL, to be delivered at the Watermoor Station of the Mid and South-Western Junction Railway Company during the Twelve Months ending June 30, 1894.
Tenders, stating whether 20 or 21 cwt. to the ton, to be sent to the undersigned not later than Thursday, June 29 next.
The Directors do not bind themselves to accept the lowest or any tender.
JOHN P. BEECHAM,
Secretary.
Gas Offices: 12, Silver Street, Cirencester,
June 10, 1893.

TENDERS FOR GAS COAL.

THE Directors of the Westerham Gas and Coke Company, Limited, invite TENDERS for a Year's supply of about 450 tons of the best screened GAS COALS, delivered at Westerham Station, in quantities to suit the convenience of the Directors.
Tenders, stating the description, and endorsed "Tender for Coals," to be sent to the Office of the Company on or before Wednesday, the 5th of July.
The Directors do not bind themselves to accept the lowest or any tender.
By order,
CHARLES HOOKER,
Secretary and Manager.
Westerham, Kent.

NEWARK GAS COMPANY.

TO MANUFACTURING CHEMISTS AND OTHERS.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR produced at their Works for One Year from the 1st day of July, 1893, at per degree Twaddel (temperature 60° Fahr.).
The Liquor to be not less than 5° in strength.
Terms, cash monthly.
Further Particulars can be had on application to the undersigned, to whom sealed tenders, marked on the outside "Tender for Liquor," are to be sent on or before the 28th inst.
The highest tender will not necessarily be accepted.
By order,
FREDK. B. FOOTTIT,
Secretary.
Newark, June 12, 1893.

NEWARK GAS COMPANY.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Newark Gas Com- pany are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Works for One Year from the 1st day of July, 1893.
Terms, Cash monthly.
Further Particulars can be obtained on application to the undersigned, to whom sealed tenders are to be sent on or before the 28th inst., marked on the outside "Tender for Tar."
The Directors do not bind themselves to accept the highest or any tender.
By order,
FREDK. B. FOOTTIT,
Secretary.
Newark, June 12, 1893.

THE Atherton Local Board invite TENDERS for the supply of 3000 tons of GAS COAL and 500 tons of CANNEL, to be delivered as required up to the end of June, 1894.
Tenders, endorsed "Gas Coal," to be delivered to me not later than Monday, June 26 inst., and should specify fully the description and quality of the Coal or Cannel offered.
DANL. SCHOFIELD,
Clerk.
Atherton, near Manchester,
June 13, 1893.

THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR to be produced at their Works for One or more Years from the 1st day of July next.
Sealed tenders, addressed to James Warburton, Esq., Chairman, to be delivered at the Gas Offices on or before Saturday, the 24th inst.
Any further particulars required may be obtained on application to Mr. T. L. SHEPPARD, Manager.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee are prepared to receive TENDERS for the supply of about 82,000 tons of CANNEL and COAL required by them during the Year ending the 30th of June, 1894.
Specifications and Forms of Tender can be obtained on application to Mr. Herbert Andrew, Gas and Water Offices, Oldham, to whom tenders are to be sent on or before Tuesday, the 27th of June, 1893.
A. NICHOLSON,
Town Clerk.
Oldham, June 8, 1893.

EASTBOURNE GAS COMPANY.

TENDERS FOR COALS.

THE Directors of the Eastbourne Gas Company invite TENDERS for the supply of 20,000 tons of best unscreened GAS COALS for One, Two, or Three Years respectively from the 1st day of September next, at the option of the Company, to be declared when the tender is accepted.
The Coals to be delivered, at the Eastbourne Railway Station, in equal monthly quantities.
Further Particulars may be obtained from, and sealed tenders, endorsed "Tenders for Coals," must be sent in not later than the 30th day of June, 1893, to the undersigned.
J. H. CAMPION COLES,
Secretary.

SOWERBY BRIDGE LOCAL BOARD OF HEALTH.
(GAS DEPARTMENT.)

THE Gas Committee of the Sowerby Bridge Local Board are prepared to receive TENDERS for the supply of 10,000 tons of best GAS COAL and 1000 tons of CANNEL COAL required in each Year, for One, Two, or Three Years, from July 1, 1893.
Specifications and Forms of Tender can be obtained by applying to the Manager at the Gas-Works.
Tenders to be sent in not later than Tuesday, June 27, 1893, endorsed "Tender for Coal" or "Cannel," and addressed to the Chairman of the Gas Committee, Gas-Works, Sowerby Bridge.
The Gas Committee do not bind themselves to accept the lowest or any tender.
JOHN MARSLAND,
Engineer and Manager.
Gas-Works, Sowerby Bridge,
June 13, 1893.

BOROUGH OF ILKESTON.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works of 5500 tons of GAS COAL.
Conditions and Forms of Tender may be had of the Manager (Mr. F. C. Humphrys), Gas-Works, Rutland Street, Ilkeston.
Sealed endorsed tenders must be delivered to the undersigned by Four o'clock in the afternoon of Wednesday, the 28th day of June inst.
The Committee do not bind themselves to accept the lowest or any tender; and they reserve to themselves the right to divide the quantity above named into two or more contracts.
By order,
WRIGHT LISSETT,
Town Clerk.
Town Hall, Ilkeston,
June 12, 1893.

UXBRIDGE AND HILLINGDON GAS CONSUMERS' COMPANY.

GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 3500 tons of GAS COAL, deliveries of which are to commence the first week of July, 1893, and finish the last week in May, 1894.
Tenders to be made out for 1500 tons of best South Yorkshire unscreened Silkstone Gas Coal, delivered in Trucks (free) at Uxbridge Railway Station, G.W.R., and 2000 tons of the best description of unscreened Gas Coal from the Durham Coal-Fields, delivered by Barge (free) alongside of the Company's Works, Grand Junction Canal.
Tenders are to state the names of the Pits from which the above description of Coal will be supplied, the same to be fresh wrought, and free from Slate and other Impurities, and to the entire satisfaction of the Company's Engineer.
Deliveries to be made according to the requirements of the Company.
Tenders to be received on or before the 1st day of July next, addressed to the Chairman, Gas Company's Offices, Uxbridge, Middlesex, and endorsed "Tender for Coal."
A Form of Tender will be sent on application.
W. & W. M. GARDINER,
Secretaries.
Uxbridge, Middlesex,
June, 1893.

MANSFIELD CORPORATION.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for their surplus TAR for One Year ending on the 30th of June, 1894.
The Tar to be removed by the Contractor when required by the Manager.
Monthly payments to be made.
The Committee do not bind themselves to accept the highest or any tender.
Tenders to be sent in on or before the 25th of June, 1893, endorsed "Tender for Tar," and addressed to
R. J. PARSONS,
Town Clerk.
Mansfield, June 10, 1893.

THE Elland-cum-Greetland Gas Com- pany offer for SALE BY TENDER, pursuant to the Provisions of the Elland Gas Order, 1878, on the 14th day of July, 1893, in lots of 10 Shares each, about 820 NEW PREFERENCE SHARES of £10 each, bearing a fixed Preferential Dividend of 4½ per cent. per Annum, contingent upon, and payable out of, the profits of each Year.
The Company's Acts of Parliament and published Statements of Account may be inspected, and printed Particulars and Conditions of Sale may be obtained, on application to Mr. Robert Porter, Engineer and Secretary, Gas-Works, Elland, Yorkshire; or to
LANCASTER AND WRIGHT,
Solicitors.
10, Piccadilly, Bradford,
June 2, 1893.

SUNDERLAND GAS-WORKS.

HENDON STATION.

THE Directors of the Sunderland Gas Company are prepared to receive TENDERS for the construction of a RETORT-HOUSE, COAL-SHEDS, PURIFYING-HOUSE, and other BUILDINGS, RAILWAY SIDINGS, and GASHOLDER TANK (153 feet diameter) at their Hendon Gas-Works at Sunderland.
Drawings and Specifications may be inspected, and Forms of Tender and Schedules of Quantities may be obtained, on payment of Two Guineas (returnable if a *bonâ fide* tender or tenders be made) at the Office of the Company, at Fawcett Street, Sunderland, and at the Office of Messrs. T. and C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Monday, the 19th inst.; and tenders must be delivered at the Office of the Company, at or before Ten o'clock in the forenoon of Tuesday, the 11th day of July next.
The Company do not pledge themselves to accept the lowest or any tender or tenders.
J. H. COX,
Secretary and Manager.
Sunderland,
June 15, 1893.

SUNDERLAND GAS-WORKS.
HENDON STATION.

CONTRACTS FOR IRON ROOFING, RETORT-FITTINGS, CONDENSER, PURIFIERS, AND OTHER APPARATUS.

THE Directors of the Sunderland Gas Company are prepared to receive TENDERS for the construction and erection of certain WROUGHT-IRON ROOFING required for the extension of their Hendon Gas-Works at Sunderland, comprising Roofs of 62, 41, 34, and 25 feet Spans, or thereabout, and also for the GAS MAKING, CONDENSING, and PURIFYING APPARATUS, comprising 192 Retort Mouthpieces, Hydraulic and Foul Mains, Condenser, Six Purifiers, a Traveller, Valves, Pipes, and other Materials and Apparatus.
Drawings may be seen, and Specifications and Forms of Tender may be had on payment of Two Guineas (returnable if a *bonâ fide* Tender or Tenders be made), at the Office of the Company, at Fawcett Street, Sunderland, and at the Office of Messrs. T. and C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Monday, the 19th inst.; and tenders must be delivered at the Company's Office at Sunderland, at or before Ten o'clock in the Forenoon of Tuesday, the 11th day of July next.
The Company do not pledge themselves to accept the lowest or any tender or tenders.
J. H. COX,
Secretary and Manager.
Sunderland,
June 15, 1893.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

TENDERS FOR GENERAL STORES.

THE Gas Committee of the Corporation are prepared to receive TENDERS for the following MATERIALS, in such quantities as may be required during the Twelve Months following the acceptance of tenders, viz.—

1. Iron.
2. Tin Sheets, &c.
3. Lead and Composition Pipes, Glass, Pig Lead, &c.
4. Bolts, Nuts, and Rivets, &c.
5. Iron Castings.
6. Brass Meter Taps and Keys.
7. Steam and Gas Tubes and Fittings.
8. Gas-Meters.
9. Paints, &c.
10. Chandlery.
11. Oils, &c.
12. Cotton Waste.
13. India-rubber Sheeting, Rings, &c.
14. Portland and Roman Cement.
15. Timber.
16. Rope, Yarn, &c.
17. Veterinary Attendance.
18. Steel Shovels, &c.
19. Brushes and Besoms.

Forms of Tender and all further Information may be obtained on application to the Engineer, Gas Offices, Bloom Street, Salford.
Sealed tenders, endorsed "Tender for Miscellaneous Goods," together with sample of Goods offered, addressed to the Chairman of the Gas Committee, Town Hall, Salford, must be delivered to me not later than Five p.m., on Thursday, the 6th of July next.
By order,
SAML. BROWN,
Town Clerk.
Town Hall, Salford.

COPORATION OF LEICESTER.
(Gas Department.)

EXHIBITION OF GAS COOKING-STOVES, ETC.

THE Gas Committee of the above Corporation intend holding an EXHIBITION OF GAS COOKING AND HEATING STOVES, ENGINES, AND OTHER GAS APPARATUS, in the Floral Hall, Leicester, from the 10th to the 15th of July next. They will provide Space, Gas, and Service-Pipes free.

Intending Exhibitors will be furnished with printed Conditions, Forms of Application for Space, and any further Information, on application to

Alfred Colson, M.Inst.C.E.,
Engineer and Manager.

Gas Offices, Millstone Lane,
Leicester, June 10, 1893.

THE Haworth Local Board of Health are prepared to receive TENDERS for the supply of 1800 tons of screened and unscreened GAS COAL, to be delivered (in such quantities as the Board may determine) on Rails at the Haworth Railway Station within the ensuing Twelve Months.

Tenders to be forwarded to me, the undersigned, marked "Coal Tender," on or before the 29th inst.

Wm. Robertshaw,
Clerk.

5, Temple Street, Keighley,
June 10, 1893.

THE Directors of the Wakefield Gas-light Company are prepared to receive TENDERS for the supply of 25,000 tons of GAS COAL and NUTS.

Forms of Tender may be obtained on application, and must be sent in, properly endorsed, not later than the 24th inst.

By order,
John W. Whitaker,
Manager.

Gas Office, Wakefield,
June 16, 1893.

THE Directors of the Ware Gaslight and Coal and Coke Company, Limited, invite TENDERS for the supply of from 900 to 1200 tons of EAST PONTOP, NEW PELTON, or PELAW MAIN GAS COALS, to be considered at their Meeting to be held on Tuesday, the 20th day of June inst.

Full Particulars may be obtained on application to me, the undersigned, at my Office.

Dated this 6th day of June, 1893.

By order of the Board,
Geo. H. Gisby,
Secretary to the Company.

Baldock Street, Ware.

ALFRETON GAS COMPANY.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the Alfreton Gaslight and Coke Company invite TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR produced at their Works for a term of One Year from July 1, 1893, to June 30, 1894.

Tar, about 90 tons; Ammoniacal Liquor, about 250 tons.

The Directors do not bind themselves to accept the highest or any tender.

Thos. Forrett,
Secretary and Manager.

Gas-Works, Alfreton.

ROCHESTER, CHATHAM, AND STROOD GAS-LIGHT COMPANY.

THE Directors are prepared to receive TENDERS for the supply of HYDRAULIC MAINS, ASCENSION-PIPES, and other FITTINGS for a Retort-Bench.

Copies of Specification may be had and Plans seen in usual office hours, at the Offices, of the Company.

Tenders, marked "Retort-Fittings," to be delivered here before Noon of Thursday, June 29, 1893.

William Syms,
Secretary.

Gas Offices: 58, High Street,
Rochester, June 1, 1893.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Tottenham and Edmonton Gaslight and Coke Company invite TENDERS for the purchase of the surplus TAR to be produced at their Works during the Twelve Months ending the 30th of June, 1894—viz., about 300,000 gallons.

The Tar can be cleared either by Railway Tanks or by Road Tanks, for cartage to the River Lea (about 1 mile distant).

Tenders must be in by Nine a.m., on Friday, the 30th inst.

Forms of Tender, together with Conditions, may be had on application to W. H. H. Broadberry, Engineer.

By order of the Board,
Jas. Randall,
Secretary.

Gas-Works, Tottenham, June 9, 1893.

NORTHWICH GAS COMPANY.

TENDERS are invited for the supply and delivery at Northwich Railway Station of about 3500 tons of good GAS COAL during the ensuing Twelve Months.

Tenders are also required for the supply and delivery of LIME and SULPHURIC ACID during the same period.

Any further Particulars required may be had on application to Mr. S. S. Mellor, Manager.

Tenders, endorsed, and addressed to the Chairman, must be delivered here not later than Ten a.m., on Saturday, June 24.

Hy. Pickering,
Secretary.

Gas-Works, Northwich,
June 7, 1893.

TENDERS FOR COAL.

THE Eccleshill and Bolton Gas Com-pany invite TENDERS for 2000 tons of GAS COAL, to be delivered at the Railway Station (G.N.R.) in Twelve Months, in such quantities from time to time as may be required.

Endorsed tenders must reach me not later than Monday morning, the 3rd prox.

J. Mellor,
Secretary.

Eccleshill, Bradford,
June 14, 1893.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are pre-pared to receive TENDERS for the supply of about 16,000 tons of screened or unscreened GAS COAL, and about 4000 tons of CANNEL, to be delivered at their Works in Carlisle in such quantities as may be directed, from July, 1893, to June, 1894.

Tenders, specifying the description of the Coal or Cannel, the Pits at which they are raised, and the terms for the net monthly payment, are to be sent on or before June 30, 1893, endorsed "Tender for Coal."

Forms of Tender to be had from

J. Hepworth,
Engineer.

Gas-Works, Carlisle,
June 7, 1893.

CITY OF CARLISLE.

TAR CONTRACT.

THE Carlisle Gas Committee are pre-pared to receive TENDERS for the surplus TAR to be produced at their Works, for a period of One or more Years from the 30th of June next.

Any further Particulars required can be obtained upon application to the Engineer, to whom sealed tenders, endorsed "Tender for Tar," must be delivered on or before June 30, 1893.

The Committee do not bind themselves to accept the highest or any tender.

J. Hepworth,
Engineer.

Gas-Works, Carlisle,
June 7, 1893.

TENDERS FOR COAL.

THE Directors of the Isle of Thanet Gas Company invite TENDERS for the supply of 12,000 tons of the best NEWCASTLE GAS COAL, to be delivered either into their Lift-Waggon on the Company's Premises, or f.o.b. Vessels in the Tyne, in equal monthly quantities, for One, Two, or Three Years, commencing delivery Sept. 1, 1893.

Sealed tenders, endorsed "Coals," to be sent in on or before Thursday, June 29, addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

Forms of Tender may be obtained on application to the undersigned.

Thomas C. Fuller,
Secretary.

Gas-Works, Margate,
June 8, 1893.

TENDERS FOR FREIGHT.

THE Directors of the Isle of Thanet Gas Company invite TENDERS for the FREIGHT and CARTAGE of 12,000 tons of Coal from the Tyne to the Margate Gas-Works for One, Two, or Three Years.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders, endorsed "Freight," to be sent in on or before Thursday, June 29, 1893, addressed to the Chairman of the Company.

Full Particulars may be had on application to the undersigned.

Thomas C. Fuller,
Secretary.

Gas-Works, Margate,
June 8, 1893.

NEW MILLS LOCAL BOARD.

THE Gas Committee of the New Mills Local Board invite TENDERS for the supply of GAS COAL and CANNEL for the Year ending June 30, 1894.

Estimated quantity of Coal 1300 tons (more or less), and of Cannel 150 tons (more or less), to be delivered, in such quantities as may be required from time to time, at the L. & N.W. or Midland Railway Stations.

Sealed tenders, endorsed "Gas Coal," with Analysis and full Particulars of the Coal offered, to be sent in, addressed to the Chairman of the Local Board, New Mills, on or before July 7, 1893.

Full particulars may be obtained from the undersigned.

The lowest or any tender not necessarily accepted.

Edw. Jones,
Manager.

Gas Office, New Mills, Stockport,
June 13, 1893.

COUNTY BOROUGH OF SALFORD.
(Gas Department.)

TAR.

THE Gas Committee invite Tenders for the purchase and removal of the surplus TAR to be produced at their Bloom Street, Liverpool Street, and Regent Road Works during Twelve Months commencing July 13 next.

The approximate quantity will be 6000 tons.

Further Particulars may be obtained on application to the Gas Engineer, Gas Offices, Salford.

Sealed tenders, endorsed "Tar," and addressed to the Chairman of the Gas Committee, must be delivered to me on or before Five p.m., on Thursday, the 6th of July next.

By order,
Saml. Brown,
Town Clerk.

Town Hall, Salford,
June 14, 1893.

HULL GASLIGHT COMPANY.

TENDERS FOR TAR.

THE Kingston-upon-Hull Gaslight Com-pany invite TENDERS for the surplus TAR for One Year, the same to be sent in to the Chairman of the Company on or before the 26th of June, 1893.

Particulars may be obtained from

Thomas Bull,
Engineer and Manager.

Gas-Works, Broadley Street, Hull.

RASTRICK GAS COMPANY.

THE Directors of the Rastrick Gas Company invite TENDERS for the supply of about 5000 tons of GAS COAL, to be delivered at their Works in such quantities as may be directed from July, 1893, to June 30, 1894.

Sealed tenders, endorsed "Gas Coal," to be sent in on or before Friday, June 30, 1893.

The Directors do not bind themselves to accept the lowest or any tender.

Alfred West,
Secretary and Manager.

Gas-Works, Rastrick,
June 17, 1893.

BRISTOL GAS COMPANY.

TENDERS FOR GAS COAL AND CANNEL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of their requirements (say, 150,000 tons) of GAS COALS, during a period commencing the 1st of September next and ending the 30th of June, 1894.

Particulars and Forms of Tender may be obtained on application to the undersigned, to whom also tenders, sealed and endorsed "Tender for Coal," must be delivered not later than Ten a.m., on Monday, the 26th day of June next.

John Phillips,
Secretary.

Chief Offices: Canon's Marsh, Bristol,
June 14, 1893.

ROCHDALE CORPORATION.

TO IRONFOUNDERS AND OTHERS.

THE Gas Committee of the above Cor-poration invite TENDERS for the supply of 1000 yards each of 3-inch and 4-inch CAST-IRON SPIGOT and SOCKET PIPES, with turned and bored Joints, weighing 33 lbs. and 51 lbs. per yard respectively. Also for such BENDS, TEES, and THIMBLES as may be required therewith. The whole to be coated externally only with Dr. Smith's Composition.

Tenders, endorsed "Pipes," stating price per ton delivered free at Rochdale Station, must be sent in to me not later than noon on Wednesday, June 28, 1893.

By order,
Zach. Mellor,
Town Clerk.

Town Hall, Rochdale,
June 17, 1893.

TAMWORTH GASLIGHT AND COKE COMPANY

TENDERS FOR GAS COAL.

THE Directors of the Tamworth Gas-light and Coke Company invite TENDERS for the supply of 2000 tons of the best screened GAS COAL, to be delivered during the Year ending June 30, 1894.

Tenders, stating price per ton, delivered free, at the Midland or L. & N.W.Ry. Station, Tamworth, in such quantities as required by the Manager, to be sent to the undersigned, endorsed "Tender for Gas Coal," on or before the 30th of June, 1893, from whom any further information can be obtained.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
W. A. Sapey,
Manager and Secretary.

Gas-Works, Tamworth,
June 15, 1893.

CORPORATION OF WARRINGTON.
(Gas Department.)

TO COLLIERY PROPRIETORS.

THE Gas Committee invite Tenders for the supply and delivery of 3000 tons of CANNEL and 20,000 tons of COAL.

Forms of Tender, with Conditions, can be obtained on application to Mr. W. S. Haddock, Engineer to the Works.

Sealed tenders, endorsed "Tender for Coal and Cannel," must be addressed to the Chairman of the Gas Committee, and sent in not later than the 6th of July next.

Fredk. Taylor,
Secretary.

Gas Offices, Warrington,
June 14, 1893.

ENFIELD GAS COMPANY.

COAL TENDERS.

THE Directors of the above Company are prepared to receive TENDERS for the supply of best SOUTH YORKSHIRE SILKSTONE and DURHAM GAS COALS for One, Two, or Three Years from the 1st of August next. About 4000 tons of South Yorkshire and 2000 tons of Durham will be required in each Year.

Copies of the Articles of Contract to be entered into, and all other necessary Particulars will be supplied on application to the undersigned, to whom sealed tenders, endorsed "Tender for Coal," must be delivered by the 17th of July next.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
Chas. W. Offord,
Secretary.

Gas Offices: Sydney Road, Enfield,
June 17, 1893.

COLNE AND MARSDEN LOCAL BOARD.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply of from 5000 to 8000 tons of GAS COALS during the next Twelve Months.

Forms of Tender and any further Information can be obtained from the undersigned, to whom tenders must be sent on or before the 30th of June.

HY. SIMMONDS,
Engineer and Manager.

Gas-Works, Colne,
June 8, 1893.

GREAT WIGSTON GAS COMPANY.

TENDERS FOR COAL.

THE Directors invite Tenders for about 2000 to 2200 tons of best screened GAS COAL, delivered at the Railway Station, Wigston, for Twelve Months commencing July 1, 1893, in such quantities as the Manager shall from time to time order.

Tenders to be addressed to the Chairman not later than the 26th inst.

The Directors reserve to themselves the right to accept the lowest or any tender.

JOHN A. HARRIS,
Manager.

WELLINGTON (SALOP) COAL AND GASLIGHT COMPANY.

TO COLLIERY PROPRIETORS.

THE Directors of the above Company invite TENDERS for the supply of about 2000 tons of good screened GAS COAL, delivered at their Siding at the Gas-Works, Wellington, during the Year ending June next.

Tenders, endorsed "Tender for Coal," to be sent to he undersigned on or before the 28th inst.

JNO. C. BELTON,
Manager.

Wellington, Salop,
June 16, 1893.

STRATFORD-ON-AVON COPORATION.

(GAS DEPARTMENT).

THE Gas Committee invite Tenders for the supply of from 3000 to 4000 tons of best screened GAS COAL or NUTS, delivered free on Rail on their Siding, Great Western Railway Company, in such quantities as may be required during the ensuing year ending June 30, 1894.

Further Particulars and Forms of Tender may be obtained upon application to the undersigned.

Tenders to be sent in not later than July 4 next.

The Gas Committee do not bind themselves to accept the lowest or any tender.

By order,
J. S. CRANMER,
Manager and Secretary.

Gas-Works, Stratford-on-Avon,
June 17, 1893.

GOOLE AND DISTRICT GAS AND WATER COMPANY.

AMMONIACAL LIQUOR.

THE above Company invite Tenders for the purchase of the AMMONIACAL LIQUOR produced at their Works (about 120,000 gallons), for a term of One Year from the 1st day of July next.

Conditions of Tender and necessary Particulars will be supplied on application to the undersigned.

Tenders, endorsed outside, to be addressed to me by the 30th inst.

The Company do not bind themselves to accept the highest or any tender.

WM. OLDFIELD,
Manager.

Gas Offices, Goole,
June, 1893.

TO PIPE FOUNDERS.

THE Directors of the Bishop's Stortford Gas Company, Limited, are prepared to receive TENDERS for the supply and delivery (carriage paid to the Bishop's Stortford Station) of

4 tons of 10-inch Socket and Spigot GAS-MAINS.
20 tons of 9 " " " "
1 ton of BENDS, TEES, &c. " "

Tenders to be delivered to me not later than the 27th of June inst.

The Directors will not be bound to accept the lowest or any tender.

By order,
WILLIAM GEE,
Secretary.

Bishop's Stortford,
June 17, 1893.

HORNSEY GAS COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS, so far as they relate to DEBENTURE STOCK only, WILL BE CLOSED on the 23rd of June inst., and RE-OPENED on the 1st day of July, 1893.

S. J. WILLIAMS,
Secretary.

63, Chancery Lane, W.C.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS of the Company, so far as the DEBENTURE STOCK only is concerned, WILL BE CLOSED on and from the 26th of June, 1893, until the 3rd of July, 1893, both days inclusive.

By order,
WALTER CROMARTY,
Secretary.

Offices: North Street, Wandsworth,
June 19, 1893.

Price 6s., Cloth Bound, Bevelled Boards.

THE

GUIDE-FRAMING OF GASHOLDERS

AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst.C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over

400,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

NOTICE OF REMOVAL.

TO GAS ENGINEERS & MANAGERS

CROWTHER BROS.,

Contractors for Retort Setting, Erection of Gas Apparatus, and General Repairs, **have removed from 384, Mile End Road, to**

152, TEVIOT ST., ST. LEONARD'S ROAD, POPLAR, LONDON, E.

MEIKLEJOHN'S PATENT

Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.

Is cheap and easily fixed to any form of main.

Will be found the most efficient appliance of the kind yet introduced.

Further particulars and price from

C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

COKE BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

FAMOUS LEESWOOD

"CURLEY CANNEL."

YIELD: 15,306 CUB. FT. PER TON OF 30·62-CANDLE POWER.

SMOOTH CANNEL.

YIELD: 12,321 CUB. FT. PER TON OF 21·321-CANDLE POWER.

PRICES AND PARTICULARS OF

MESSRS. S. CHANDLER & SONS,
LEESWOOD COAL AND CANNEL MINES,
PONTYBODKIN, nr. MOLD, NORTH WALES.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,
15, HANOVER STREET,
EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Company, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cen'.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE,

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]

FALMOUTH GAS COMPANY,
Offices: *Church Street, Falmouth,*
January 25th, 1893.

Messrs. the

WEARDALE IRON & COAL COMPANY, LTD.,

NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL,** received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{15}{20}$ tons of the Coal, mixed with 9$\frac{6}{20}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{15}{20}$ tons.
Cannel Shale: 9$\frac{6}{20}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13$\frac{1}{4}$ cwt.

The ILLUMINATING POWER averages from 11 daily tests, **16·54 CANDLES,** which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,
J. WM. BUCKLEY,
Engineer and Manager.

For Price, &c., apply to the

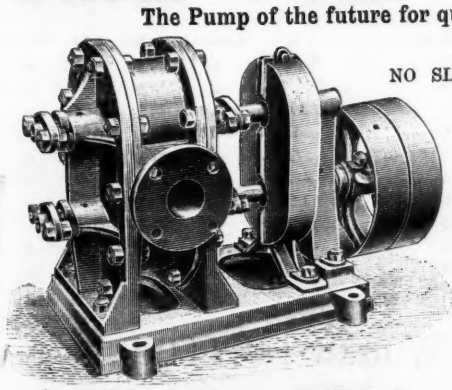
WEARDALE IRON & COAL Co., Ld.,

QUAYSIDE, NEWCASTLE-ON-TYNE.

JOHNSON'S PATENT

DRUM PUMP AND GAS EXHAUSTER.

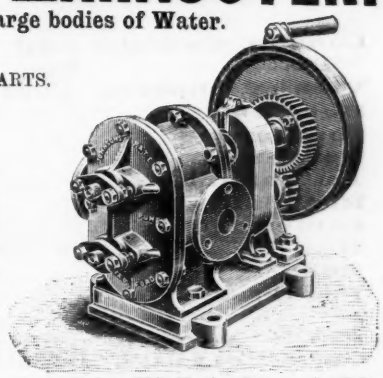
The Pump of the future for quickly and economically moving large bodies of Water.



As supplied to the Harrogate Gas-Works for Pumping Gas Liquor.

NO SLIDES OR FRICTIONAL WORKING PARTS.

The Centrifugal Pump has large capacity, but is limited in power. The direct-acting Piston Pump has great power, but is limited in capacity. The Drum has the capacity of the former with the power of the latter; the advantages of both, with the disadvantages of neither.



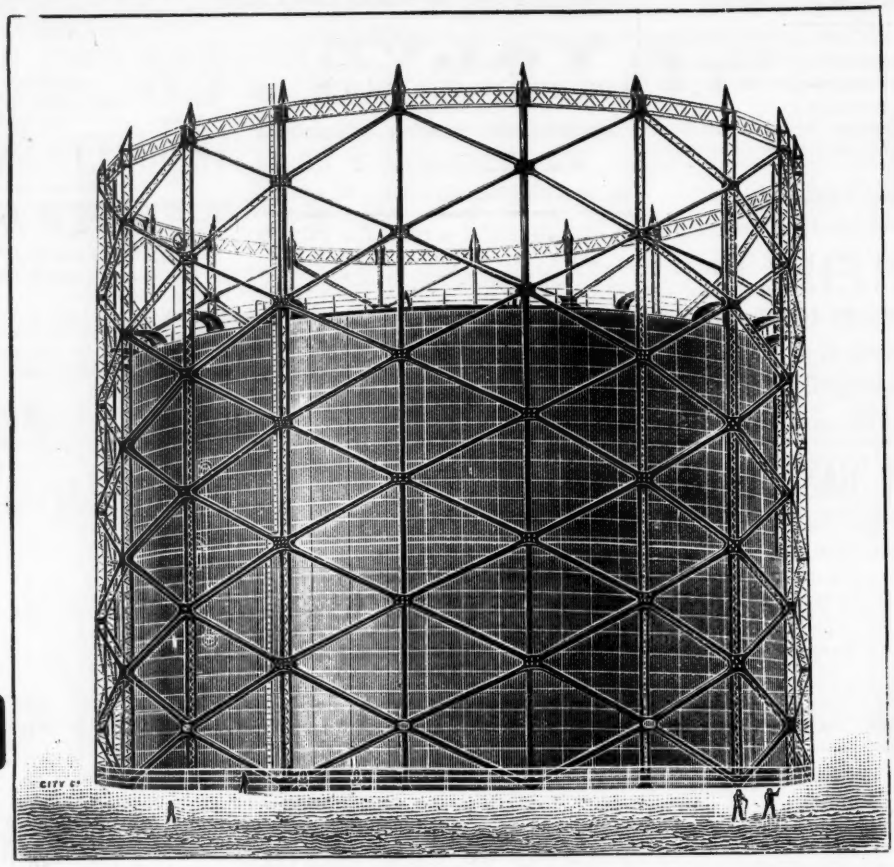
Assupplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

DRUM ENGINEERING COMPANY,

Hydraulic and Pneumatic Engineers, 55, ATHOL ROAD, BRADFORD.

GASHOLDERS.

Light Safe Cheap



Light Safe Cheap

CUTLER'S PATENT GUIDE-FRAMING

AS ILLUSTRATED ABOVE, AND AS ADOPTED AT

Tunbridge Wells, Shanklin, Hornsey, Southend, Rochdale, &c.,

OFFERS MANY ADVANTAGES, COMBINING GREAT STRENGTH AND RIGIDITY WITH A LIGHT PLEASING APPEARANCE AT SMALL COST.

No Piers are required for its support; saving some 20 per cent. in cost of Tank.

The following are among the many Holders of various designs recently constructed or now in hand.

London Gaslight and Coke Company . .	3-Lift	197	feet	by 50	feet.
Do. Do. . .	3 „	247	„	by 55	„
Vienna Imperial Continental Gas Assoc.	3 „	204	„	by 41	„
Hornsey	3 „	110	„	by 35	„
Southend	2 „	90	„	by 25	„
Rochester	3 „	78	„	by 14	„
Tottenham	3 „	150	„	by 32	„
Rochdale	4 „	150	„	by 34	„
Cambridge	2 „	120	„	by 25	„
Hull	3 „	81½	„	by 30	„
Bombay	2 „	82	„	by 24	„
Frankfurt	3 „	80	„	by 25	„

EVERY REQUIREMENT FOR GAS-WORKS SUPPLIED.

SAML. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL, LONDON.
16, GT. GEORGE ST., WESTMINSTER, S.W.

AUG. KLÖNNE,
DORTMUND (GERMANY).
REGENERATIVE FURNACES.
Unsurpassed in
Efficiency, Economy, Durability, and Easy Working.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on application

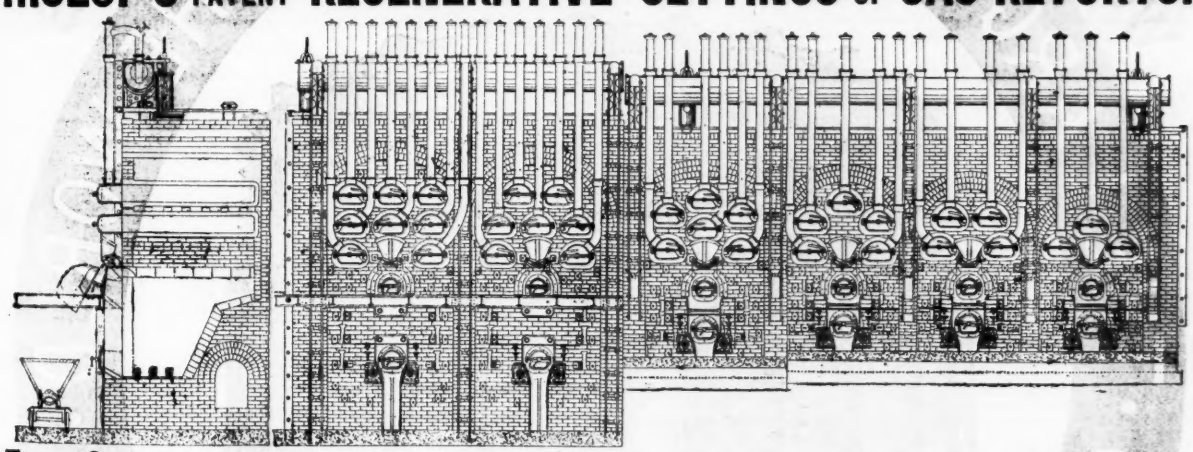
For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**
ADDRESS
JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

WILLEY & Co.,
Gas Engineering Works, Commercial Road, Exeter,
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.
PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**
PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.
Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.
Special reference and attention are invited to our
WET AND DRY METERS,
which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS
Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

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JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,

CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works

(also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

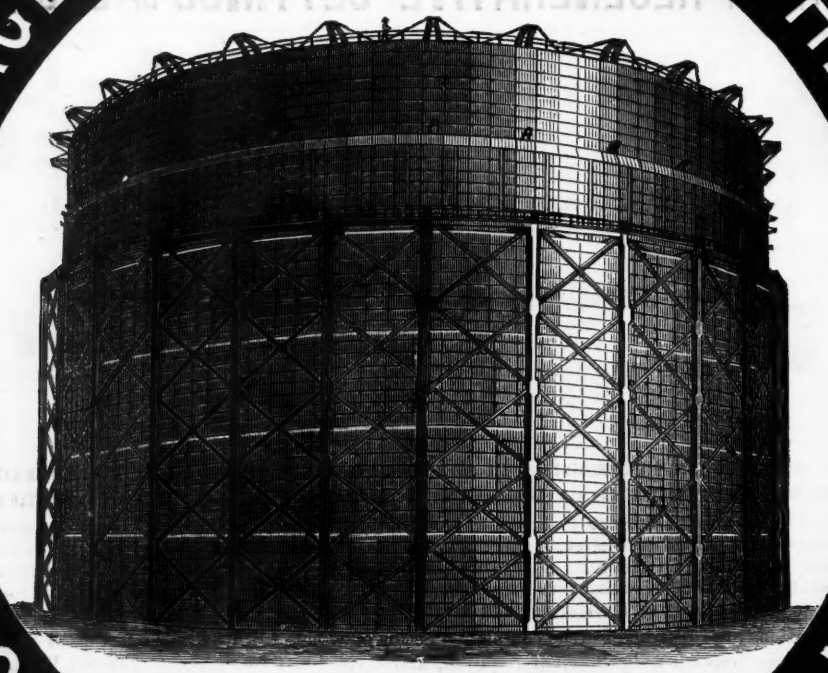
CLAYTON SON & Co. LTD

MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY



CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAM.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.

TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

JOHN BROTHERTON, Limited,

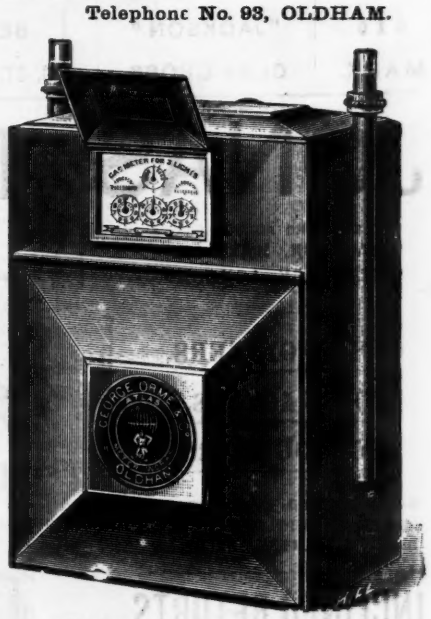
IMPERIAL TUBE WORKS,
WOLVERHAMPTON.

MANUFACTURERS OF
WROUGHT-IRON TUBES AND FITTINGS FOR GAS, WATER, STEAM, AND ALL OTHER PURPOSES.
Also of IRON and STEEL CYLINDERS for the conveyance of COMPRESSED GAS.
PRICES ON APPLICATION.

GEORGE ORME & CO.,

MANUFACTURERS OF IMPROVED WET AND DRY GAS-METERS,
ATLAS METER WORKS, OLDHAM.
Telegraphic Address: "ORME OLDHAM." Telephone No. 93, OLDHAM.

WET GAS-METER IN CAST-IRON CASE.



DRY GAS-METER IN STRONG TIN-PLATE CASE.

No. 200.

ORME'S GAS REGULATOR (BEHL'S PATENT) FOR STREET LAMPS,
AS ILLUSTRATION NO. 200.
Adopted by the leading London and Provincial Gas Companies. More than 150,000 now in use.
ORME'S PATENT SUSPENSION REGULATORS.
Prices and full particulars on application.

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General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS
Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES
AND
CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,
CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
CXC	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S
IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE, APPLY TO

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ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

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CHANCE BROTHERS, OLDBURY (Four Apparatus).
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NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
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And to the following Gas Companies and Corporations—

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"ECLAIRAGE, LONDON"

TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
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IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.

RETORT SETTERS,
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ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS

GASEOUS FIRING A SPECIALTY.

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

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OVENDEN, HALIFAX.

Now Ready, Price One Guinea.

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS & WATER UNDERTAKINGS.

1879-1890.

By E. H. STEVENSON and E. K. BURSTAL, MM.Inst.C.E.

The Work published in 1879 by the late Mr. Stevenson is still on sale.

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BEST FIRE-BRICKS, GAS-RETORTS,

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Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

ESTABLISHED 1836.

HENRY BALFOUR & CO.,

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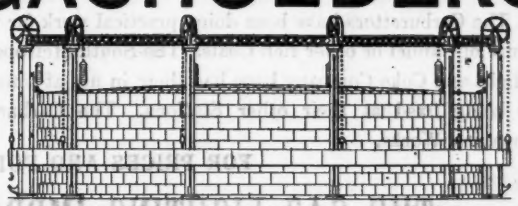

PRESSURE-REGULATORS FOR GASHOLDERS (See "JOURNAL" Dec. 20, 1892).

FOUR-WAY VALVES,

AND ALL CLASSES OF GAS APPARATUS.

HENRY PUPLETT, 47, Victoria Street, S.W.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

Telegrams: "ATLAS SHEFFIELD."

R. & J. DEMPSTER,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

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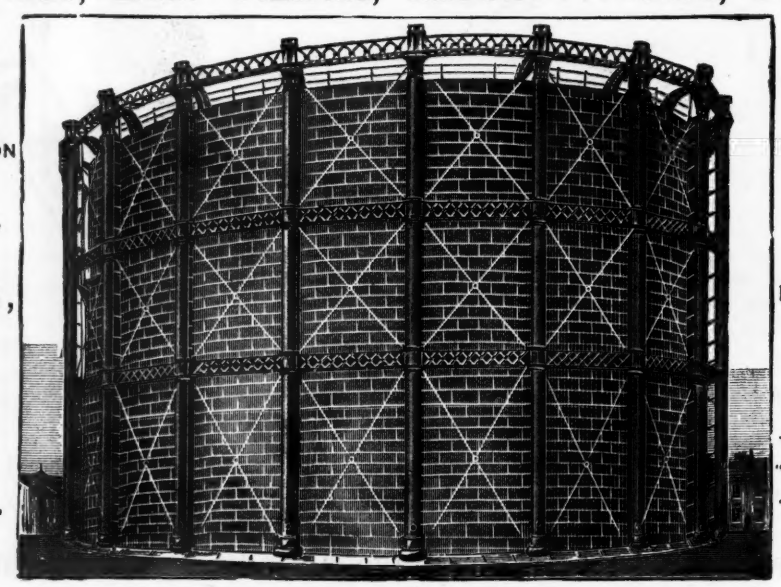

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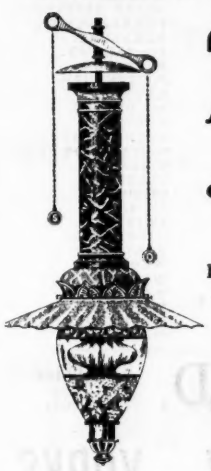

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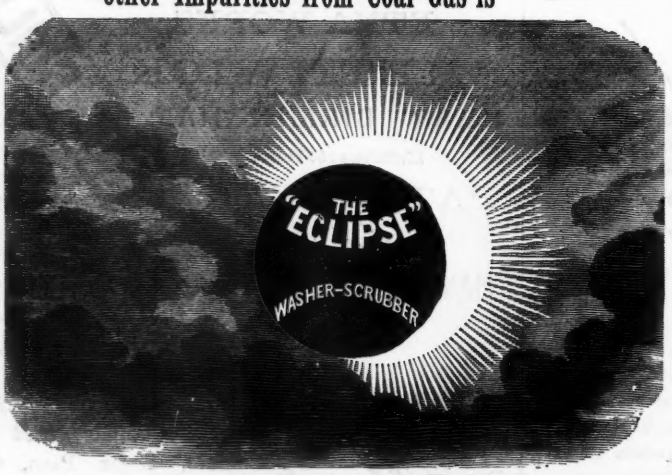

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Whilst the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

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